MAY

THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION

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Metastatic Lesions—*Rickert*
Pulp Abscesses and Root Resection—*Hatton*
Drugs in Root Canal Treatment—*Coolidge*
Pulpless Tooth Problems—*Walker*
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President Elect of the American Association of Dental Schools

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Original Communications

MORPHOLOGY OF ROOT CANALS*

By WILLIAM G. SKILLEN, D.D.S., Chicago, Ill.

IT IS doubtful that any surgeon has a more difficult problem to solve, or one that requires more patience and skill, than that involved in pulp treatment. Necessarily, if a thorough knowledge of the situation is needed by the surgeon to enable him to solve his problem, such knowledge becomes of paramount importance in the solution of the pulp problem.

There is little doubt that a tremendous amount of work has been attempted in the field of pulp treatment, with but little if any real preparation or real knowledge of the structures involved. Under such circumstances, probably luck only has stood in the way of failure. Only through long and constant critical study of all the varying phases of the subject, I believe, can the final solution of the problem be hoped for.

In presenting the morphology of the root canal, an attempt has been made to select and limit the subject to those matters about which we seem to have some knowledge and which appear to bear some relation to the diagnosis, treatment and prognosis of the pulp-involved tooth. Only in one or two instances has an attempt been made here to suggest how a particular situation might be met, such matters having been left to those who have had more practical experience.

From the anatomic standpoint alone, the root canal seems a complicated structure to deal with. Apparently, there is nothing constant about it, nothing upon which one may pin expectations.

If the work of such men as Preiswerk, G. Fischer, Hess and others is to be depended on, the root canal proper seems to vary tremendously from tooth to tooth and from time to time, apparently un-

*From the Department of Histology, Northwestern University Dental School.

*The papers of Drs. Skillen, Rickert, Hatton, Coolidge, Walker and Adams were presented as a symposium on the pulpless tooth problem.

*Read before the Section on Operative Dentistry, Materia Medica and Therapeutics at the Seventy-Third Annual Session of the American Dental Association, Memphis, Tenn., Oct. 20, 1931.

TABLE 1.—CANALS PER TYPE OF TOOTH*

Tooth	Total No.	Number of Canals 1 Per Cent	2 Per Cent	3 Per Cent	4 Per Cent
1, 2, 3	682	100.0			
4	260	19.5	79.5	1.0	
5	246	56.0	42.0	2.0	
6, 7	513			46.5	53.6
6, 7	512	0.3	17.0	78.0	4.0

*This table and Tables 2-3 were compiled from Hess and Zürcher: Anatomy of Root Canals, 1925.

TABLE 2.—PERCENTAGE OF TEETH PRESENTING AN APICAL FORAMEN AND MARROW CANALS

Tooth	Total No.	Foramen Per Cent	Marrow Canals Per Cent
1	280	25	21.4
2	248	31	22.0
3	154	25	18.0
4	260	40	18.0
5	246	49	19.0
4	75	44	17.3
5	65	51	20.0
6, 7	513	67	16.0
6, 7	512	73	13.5

TABLE 3.—APICAL RAMIFICATIONS: NUMBER AND PERCENTAGE OF OCCURRENCE WITH AGE

Age	10–20		20–30		30–40		40–55		Total—All Ages		
Tooth										Per Cent	
1	20	2	190	50	40	12	30	5	280	69	25
2	22	2	140	50	60	19	26	6	248	77	31
3	40	3	69	23	40	10	55	3	154	39	25
4	20	3	160	64	40	27	20	11	260	105	40
5	16	6	156	72	50	28	24	15	246	121	49
6–7	98	22	240	192	127	102	48	28	513	344	67
1–2	30	0	60	17	32	12	14	3	136	32	24
3	15	1	63	29	30	15	18	4	126	49	39
4	10	1	40	21	25	11			75	33	44
5	5	1	34	18	26	14			65	33	51
6–7	80	5	210	156	200	179	22	19	512	376	73
Total	356	46	1362	692	670	429	257	94			
Per Cent	12.9		50.8		64.		36.5				

dergoing constant change from the moment the tooth erupts. It therefore becomes difficult, if not impossible, to describe it. The simple, wide open root characteristic of the tooth during the eruptive period sooner or later becomes constricted and divided, the canals increasing in number and becoming complicated by the development of all manners of channels, offshoots, recesses and

irregularities. Both normal and pathologic processes may share in bringing about these varied and intricate changes; resorption and the presence of deposits

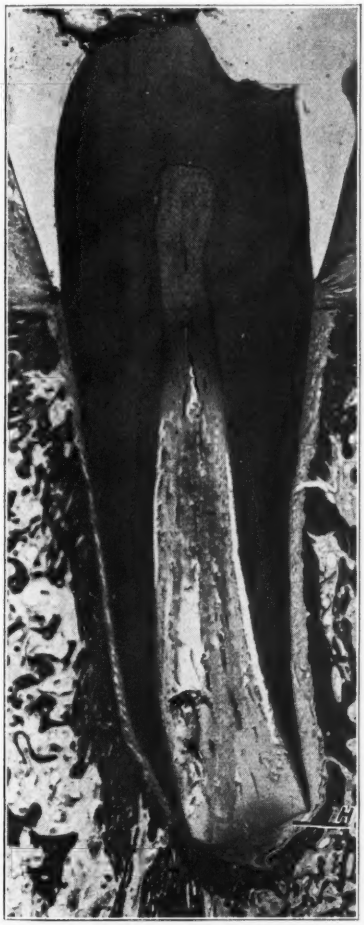

Fig. 1.—One example of form of pulp canal of a bicuspid at time of eruption. *H*, Hertwig's sheath.

of an inflammatory character often resulting in roughening, enlarging, narrowing or otherwise complicating even simple canals; not to mention the more profound changes created in naturally complicated areas. Such characteristics are so varied and changing that they defy description. Only a close study of the work which has been done in this direction can give a faint idea of the facts regarding root canal anatomy.

Some believe that these changes go on throughout the life of the tooth. Szabó considers constriction of the canal to begin and continue rapidly with eruption of the tooth. Trueb believes this process continues during the entire life of the pulp. Hess is more specific. According to him, constriction and division of the canal, and other changes, reach their most complicated state between the ages of 20 and 40 years, which is, perhaps, from the standpoint of pulp involvement, the most crucial period in the life of the tooth. After 40, some simplification in canal form seems to occur through the complete calcification of some of the pulp ramifications. According to this writer, too, the upper anterior teeth seem to be the only ones which are likely to retain a more simple form of canal, one which conforms more or less to the external shape of the root.

The work of these men rather pointedly emphasizes the inaccessibleness of most canals. And, indeed, it seems to be the conclusion of all those who have studied the subject at first hand, who have actually observed the complexities of form characteristic of the root canal, that it is, in most instances, practically impossible to remove the pulp in its entirety.

Added to these complexities is the variation in the main canal as it communicates with the periodontal membrane, the tissue surrounding the root of the tooth.

This is described in a varied terminology as multiple or single foramina, accessory canals, lateral canals, etc. Such branching of the main canal may occur almost anywhere on the root of a tooth; in the bifurcation of multirooted teeth; on the lateral surfaces, and, particularly, as is well known, in the apical region. They all fulfil a similar function, affording passage for the several vessels which enter and leave the pulp. Although we do not know a great deal about the development of these canals, their formation, arrangement and number are due, probably, as Barrett and Thomas point out, to the arrangement or distribution of the circulatory vessels in their passage to and from the pulp. Those which occur in the bifurcation and on the lateral surfaces of the root pass through both dentin and cementum; while those occurring in the apical region may, in some instances, be entirely formed in cementum.

Fig. 2.—Root canal of upper central incisor at 50 years of age; single, relatively large, apical foramen; no indications of further decrease in size.

The number, arrangement and the occurrence of these canals in any particular type of tooth, and probably at any particular time, are so varied as to defy description. And although at times close examination may reveal something of the

condition of the main canal, it is seldom or never that even the closest study will reveal the presence or arrangement of these relatively small branchings. According to Hess, these canals increase in number up to the age of 40, after which time they appear to diminish in number, presumably owing to calcification of their soft tissue contents. They occur in all types of teeth, according to this writer, but more numerously in the bicuspids and molars.

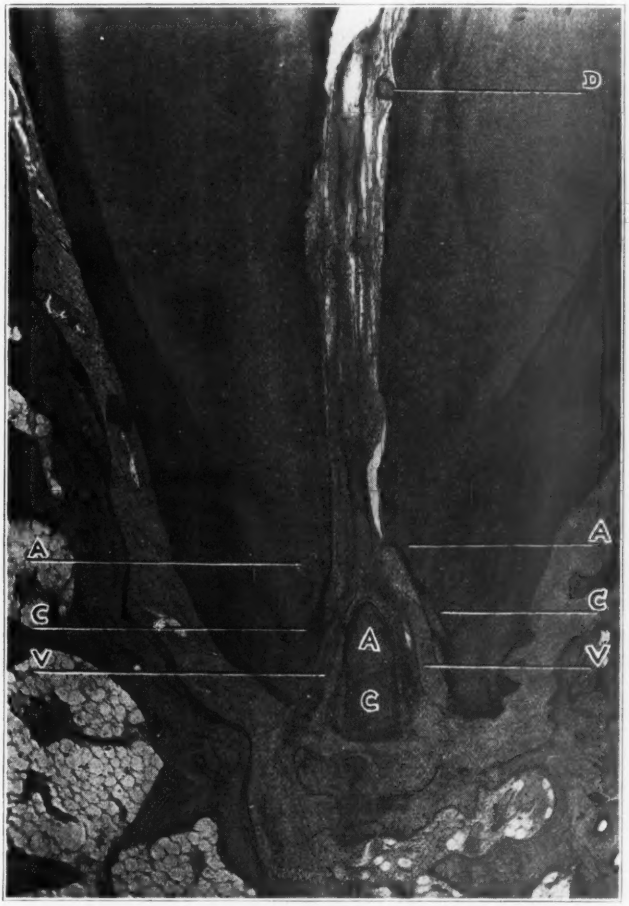

Fig. 3.—Root canal of upper central incisor at age of 50; walls of canal slightly irregular with denticle at *D;* two apical foramina surrounded partly by dentin *A* and partly by cementum *C; V,* vessels passing through each foramen.

The contents in detail of these canals are more or less uncertain, variable in

quantity and structure. One or more circulatory vessels, a nerve and a variable quantity of an apparently fibrillated connective tissue may sometimes be discerned, this depending a good deal on the size of the channel. Whether this tissue should be designated as pulp, periodontal membrane or both is a question, and one of apparently little import as both the structures named consist funda-

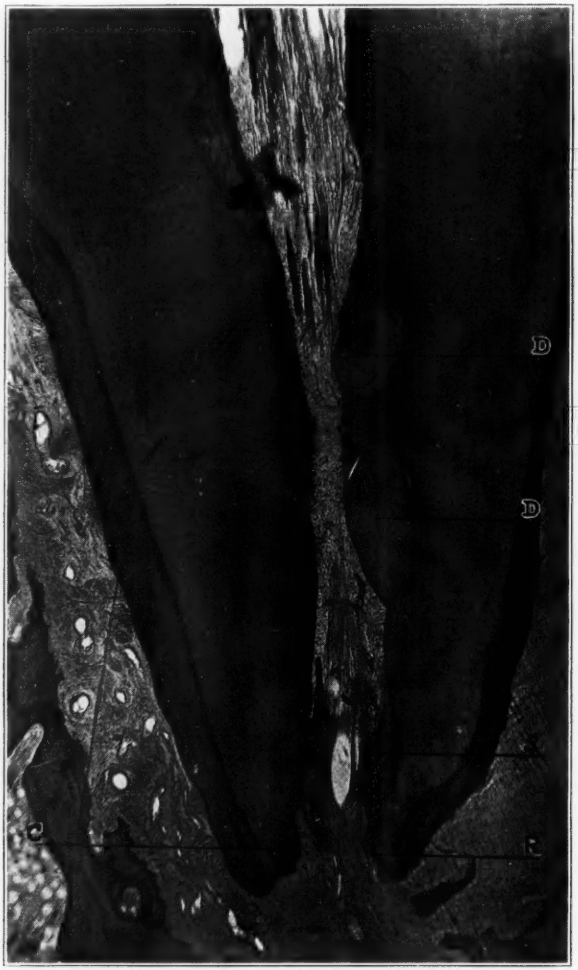

Fig. 4.—Root canal of upper central incisor at age 45; constriction of canal by denticles *D*. *S*, secondary dentin. *R*, resorption. *C*, cementum. There is one apical foramen.

mentally of a potentially similar type of tissue.

The orifices of these canals may also vary widely. Some bell out; some maintain a uniform diameter and some are even more constricted at their mouth than elsewhere.

They too, like the main canal, are subject to numerous changes. While they may decrease in size, and some may even become entirely obliterated, perhaps at any age, they may, on the other hand, be enlarged through resorption of their walls. Barrett[5] claims that few are found either partially or completely calcified, while enlargement, to the extent of two or more being united into one, is of frequent occurrence. The latter change seems likely to occur in the presence of inflammation in the pulp or adjacent tissue, and perhaps forms part of the reparative picture following pulp extirpation. After resorption, if reconstruction takes place, cementum will be laid down. In this process, apparently, a canal of a group infrequently may become entirely obliterated. More often, it would seem that all the tooth tissue which had been removed is not restored and the canal or the canals remain larger than they were in their previous condition.

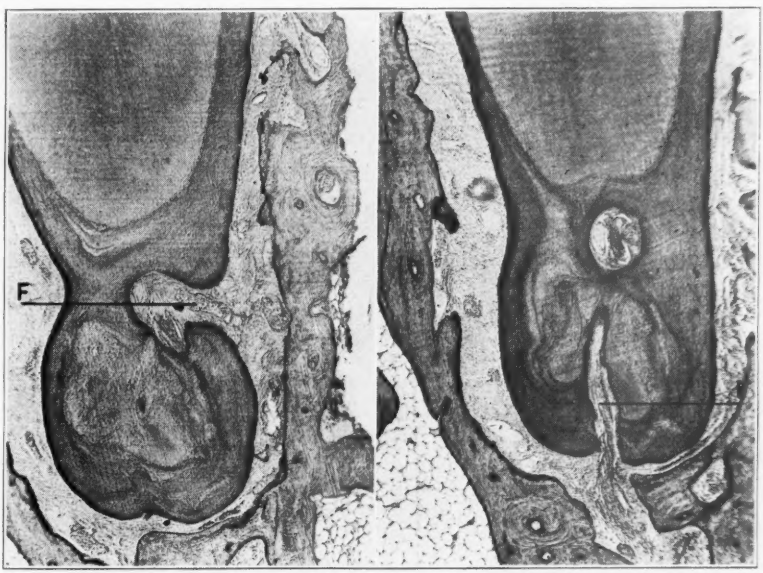

Fig. 5.—Two views of apical region of a lower incisor at age 50. The serial sections disclosed the presence of two apical foramina *(F)* in this tooth, the one directed labially and laterally, and the other slightly lingually and apically.

It is difficult to say just what bearing all such channels may have on the problem at hand. We do not know a great deal about what happens in them after pulp extirpation, especially under any particular circumstances, or why. Certainly it would seem impossible to re-

move the contents of most of them. For this reason, G. Fischer considered all pulp extirpation as unsatisfactory or unsafe. At the same time, it is possible to see that the more or finer the apical region of the tooth is canalized, the less the danger of injuring, either mechanically or chemically, the periapical tissue. Blayney views these apical ramifications in a rather favorable light. He sees in their number a resemblance to a collatmen exists, and certainly failures occur in both. Perhaps the form of the apical region has little to do with subsequent results. It is not difficult to find other attributes which readily afford an explanation. Viewing things from a somewhat different angle, Chiavaro believes that there is a definite relation between the form of the apical area and the reaction of the pulp to injury. He believes that the larger the apical portion of the

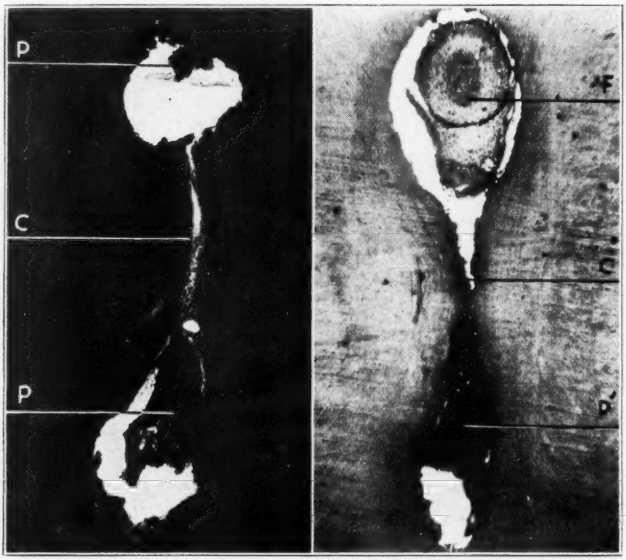

Fig. 6.—Transverse section of canal of a bicuspid showing very common arrangement of canal. *C,* very constricted channel uniting main canals and containing pulp tissue. *A,* results of attempt to remove pulp by mechanical means, each canal being entered twice, with no curettement. *P,* pulp left in canals. *B,* extracted tooth which at some time had been treated, similar in character to *A*. *F,* root filling. *P'*, degenerated pulp remaining in main canal and connecting channel *(C)*.

eral circulation which would insure greater possibilities for the survival and reconstruction of the apical area after pulp removal than where only a single foramen exists. Reconstruction seems to occur just as well where only one foracanal, the greater the resistance of the pulp to injury and infection. In other words, strangulation with the resulting death of the pulp is less likely to occur, or will occur much more slowly, when the apical channel is large. This belief

would seem to receive some support through the results of those experiments which have been conducted on teeth of persistent growth. The facts of the matter are sadly lacking, and no definite statement as to the significance of these structures is possible.

I have indicated some of the difficulties, from the anatomic standpoint, which seem to stand in the way of removing all pulp and filling canals thoroughly and tightly should this become necessary. when the pulp comes away dangling in full sight on the end of the broach, do not believe for a moment that it has come away in its entirety; for, in all likelihood, considerable tissue has been left adhering to the walls of the canal. Müller and Stitzel conducted experiments of a mechanical and chemical nature, under ideal conditions, to determine the feasibility of removing all the contents of the canal and leaving it in a clean condition. When the teeth were

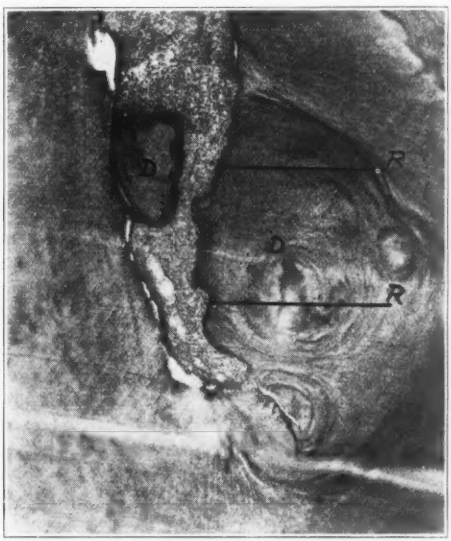

Fig. 7.—*D*, denticles constricting canal. *R*, old resorption lacunae probably due to inflammation present in pulp.

Even when conditions are most favorable and the canals are accessible, it should not be thought for a moment that the pulp can be removed except by painstaking effort. This tissue maintains quite a tenacious hold on the walls of the canals, a fact explainable possibly on the basis of the continuity of the dentinal fibrils with the dentinal tubules, and of Korff fibers with the dentin matrix. Even finally sectioned and examined, these workers were greatly surprised at the amount of tissue which had not been removed from various parts of the canals of these teeth. These experiments showed also that it could not be determined definitely where the pulp would break away. This might occur at any place and in various ways. The few experiments that I have conducted myself along this line,

fully bear out the findings of Müller[9] and Stitzel.[10] Only the most thorough and prolonged curettement of the walls of the canal seems to offer hope for satisfactory accomplishment in this direction. Such treatment perhaps is indicated as necessary for another reason besides pulp removal.

Very often, there will exist on the pulpal surface of the dentin a thicker or thinner layer of uncalcified matrix or dentinoid. This tissue is comparable to that

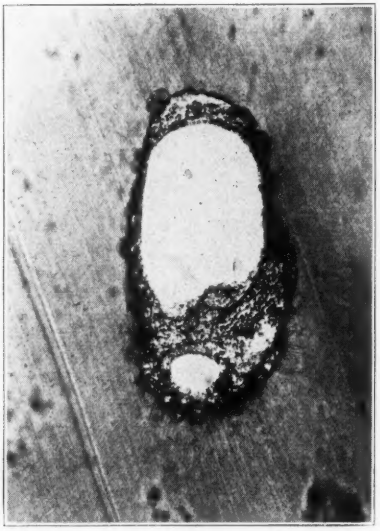

Fig. 8.—Old resorption lacunae in presence of a degenerating, infected pulp, tissue remaining in apical region after attempt to remove it by mechanical means. The canal was entered three times with three different sized broaches.

which occupies the uncalcified areas in dentin designated as interglobular spaces. Such areas become actual spaces only on the drying out and shrinkage of this uncalcified matrix. It is just possible that a similar thing may occur along the wall of the canal when the pulp is removed and the tissues dehydrated. If this shrinkage occurs before the root filling is placed, perhaps all will be well provided crevices are not afterwards formed between the filling and the canal wall. Thorough curettement of the wall in order to at least reduce the thickness of this dentinoid layer would seem to be indicated. Some study in this direction is perhaps desirable.

Some discussion has centered around the relation between the dentinal tubules and the problem at hand. Perhaps, too, the permeability of the cementum and permeability at the dentinocemental junction may require some attention.

We know that the dentinal tubules are quite numerous. Römer has estimated their number in the crown region of the tooth to run as high as 37,600 per square millimeter of tooth substance, with an average of 14,700 at the dentino-enamel junction. Apparently, no estimates have been made relative to the root. (V. Ebner's statement in Scheff's *Handbuch* in regard to Römer's findings in the latter connection cannot be corroborated by the original work of the latter. Römer seems to have limited his efforts to the crown region.) Our own estimates to date have reached as high as 39,500 and more tubules per square millimeter for the crown region and the pulpal half of the dentin wall, and an average of 17,968 for the root area. The lowest figure found so far for the root region has been 10,320, and the highest 38,160, per square millimeter. The former figure is from an area somewhat distant from the pulpal wall, the latter, close to that surface. This would indicate that the tubules become more widely spaced in the matrix as the outer surface of the dentin is approached.

Tubules in the root usually exhibit a great many more short, lateral branches than do those in the crown region.

Whether or not these branches anastomose has not, apparently, been determined.

What the contents of these tubules are is, it seems, open to question. There is no doubt that some, perhaps a great many of them, contain lymph and dentinal fibrils; but whether they all do, and whether the fibril extends the entire length of the tubule, I do not believe has been determined.

A great many of these tubules may become cut off from the pulp by the formation of various types of secondary dentin. If resorption of this secondary deposit takes place, the tubules may again be brought into communication with the pulp. What has happened to the contents of these tubules in the interim is a question about which we know no more than we know about what happens in them after pulp removal. Such knowledge would seem to be necessary before conclusions can be drawn as to the relation of these structures to pulp treatment.

Fig. 9.—Marks of resorption having occurred in numerous apical foramina in a bicuspid at 30 years of age. *P*, only pulp tissue left.

In root resection, as there is no question that myriads of them, with their interlacing branches, are exposed, the nature of these structures under these circumstances, and their potentialities, may be of considerable importance.

In the apical region, there appears to

Fig. 10.—*P*, pulp remaining in apical region after mechanical removal and fairly thorough curettement. *D*, dentinoid or uncalcified dentin.

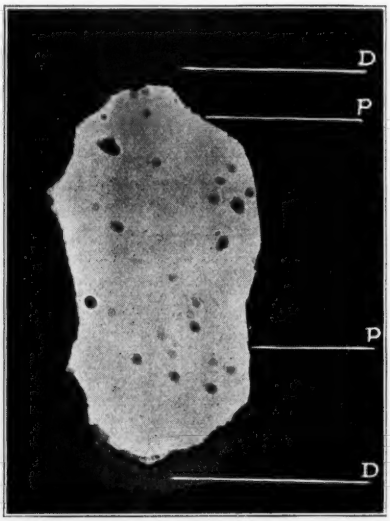

Fig. 12.—Apical region of upper central incisor at age 30, showing, at *D*, dentinoid tissue or uncalcified dentin, some irregularity of canal wall and thin layer of pulp left adhering to wall after mechanical removal of the pulp without curettement.

Fig. 11.—Left: *D*, denticle with pulp tissue *(P')* enclosed within it. *P*, pulp remaining in canal after attempt to remove it by mechanical means; no particular curettement. Right: Somewhat similar instance which had been treated at some time. *F*, root filling. *C*, calcified tissue enclosing atrophied pulp *P*.

be, in many instances, a structural continuity between dentin and cementum which involves the dentinal tubules, the granular layer and the lacunae and canaliculi of the cementum. Box and others have called attention to the fact that sometimes it is impossible to distinguish clearly the boundary between one tissue and the other. These channels seem adequate to enable fluids to pass from one tissue to the other.

There is some slight experimental evidence that fluids pass in one direction at least, namely, from cementum to dentin, and the pathway by which this occurs has been pointed out.

In many instances, there is a distinct line of demarcation between the two tissues, dentin and cementum, in which there appear no actual channels capable of transmitting fluids. Moreover, there appears to be no evidence at the present time of an experimental nature which would indicate that fluids may pass from the dentin into and through the cementum; an essential and important factor in the problem under discussion.

The permeability of the cementum itself is an assured fact, and one which may play an important rôle in prognosis when infection has once developed in the periapical area. Living cells, the cement corpuscles, are usually present in the cementum of the apical area. In order to maintain life, these cells must receive a nutritive supply, which probably enters the cementum from the periodontal membrane. No evidence as yet has been forthcoming that these cells lose their vitality on the loss of the pulp, which indicates that they receive some nutrition from that source. On the other hand, degeneration and death of these cells can be observed, taking place in the presence of destructive processes in the periodontal membrane. Whether this indicates that the nutritive supply only to these cells has been shut off or that infection has also penetrated

Fig. 13.—Almost complete obstruction of a canal by denticles *D*. *P*, pulp.

the cementum may be a question. In either case, permeability is playing an important rôle in that a necrotic cementum has now developed; and, in this connection, it should be kept in mind that, unlike bone, necrotic cementum, because of its anatomic arrangement, cannot be exfoliated. Its removal can be accomplished only by a relatively slow, piecemeal resorption from the periodontal surface.

Finally, in the pathologic process which develops in the pulp and in the periapical area, as well as in any reconstruction process which may be set up after pulp extirpation, the epithelial rests, which may be present in both these areas, may play an important rôle in the outcome.

The presence of these structures in the periodontal membrane, and their relation to cyst formation, have been recognized for a long time; but the presence of these structures in the pulp, and their reaction

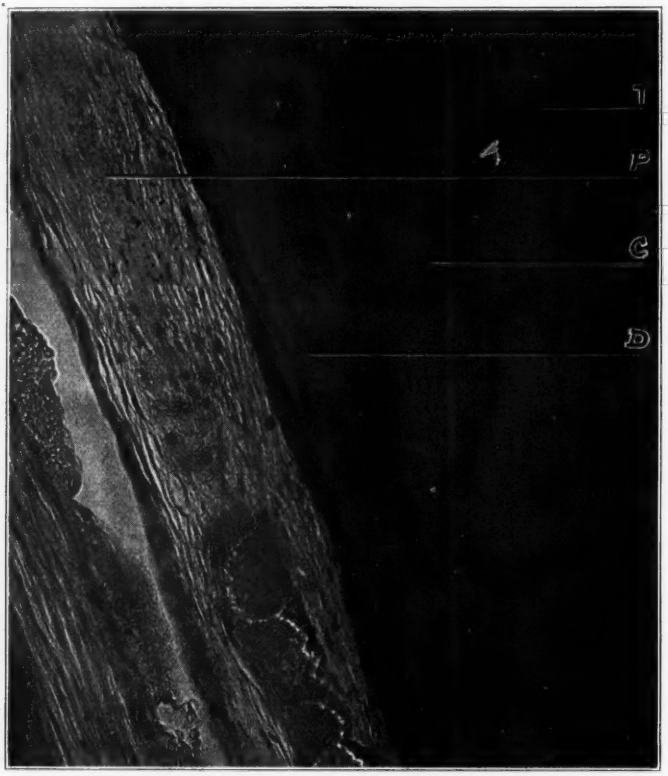

Fig. 14.—Dentinal tubules *T* cut off from pulp *P*, by formation of two types of secondary dentin, *C*, cemental in appearance (note lacunae), and *D*, homogeneous type. This tooth was not affected by caries, the pulp apparently was not involved, and the whole root canal was of this arrangement.

in the presence of inflammation, have received attention only recently. Of particular importance perhaps is the fact that these epithelial rests are present very frequently in the apical regions of the pulp, areas the reconstruction of which, following pulp extirpation, they may retard, as they too, in the presence of stimuli, may proliferate and lead to cyst formation.

Fig. 15.—Apical region of pulp canal in which, in region outlined, are epithelial rests. (Compare Figure 16.)

From all this, you will perhaps have obtained some idea as to why it was said in the beginning that the root canal seemed to be a complicated structure. Add to these seemingly complex anatomic features the fact that we know really very little of their relation to the problem at hand, and the fact that the exact nature, structure and condition of the canal at all times are practically hidden from view, and it would seem that we have a better explanation for the failures which arise in root canal treatment than for the successes. Certainly it would seem that a much more thorough knowledge of all the possibilities is necessary before the final solution of the problem will be arrived at.

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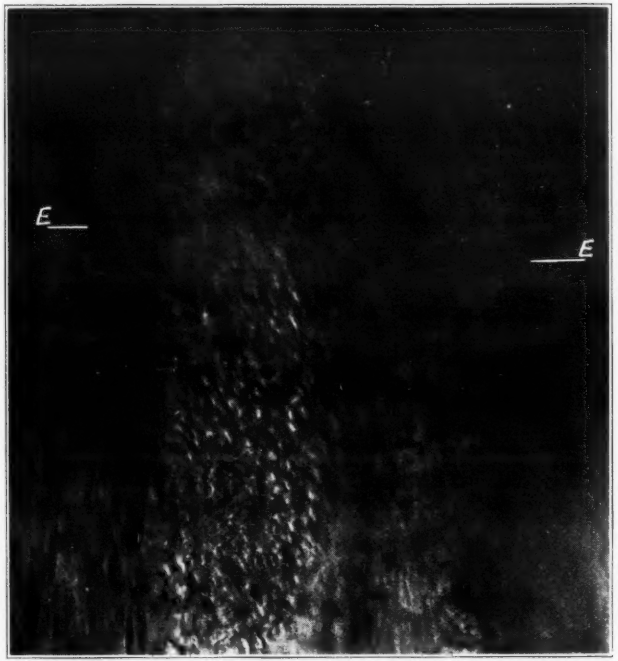

Fig. 16.—Epithelial rests *E*, in pulp in region outlined in Figure 15.

Fig. 17.—*E*, proliferating epithelium in apical foramen and pulp in inflammation of the pulp. Resorption (*R*) is taking place within and without the canal.

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METASTATIC LESIONS IN RELATION TO PRIMARY FOCI*

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THE patient is recovering. During the past twenty years, several hundred thousands of physicians and dentists have attempted diagnoses. To many, until quite recently, the case seemed hopeless, but during the past year recovery has been so rapid that the health of the patient may soon be completely restored. Until three years ago, root surgery was coming more and more into ill-repute. In some communities, and even in some states, many dentists took pride in disavowing interest in the practice.

During the past year, in both Europe and America, there has been a renewal of interest in the pulpless tooth. More practitioners have sent inquiries to the schools for suggestions as to specialization in diagnosis, and oral and root surgery. In fact, it has been a long time since so many state societies have demanded the teaching of root surgery technics on their programs. We may well ask, will the time ever recur when we will find it necessary to "apply four wheel brakes" to steady this movement in the opposite direction?

Your program committee has, and wisely in view of the present tendencies, presented in a symposium accessible to all operators the subject matter as it stands today. In a broad and unprejudiced discussion of the focal infection problem, with which the pulpless tooth has been so generally associated, one must admit that absolute proof of its relation to secondary effects is still incomplete. Because of this, I shall briefly review the present status of the subject.

In order that I may bring to you the most recent views as expressed at the International Congress, held at Paris in August of this year, I shall present extracts from my own views as expressed at that meeting, accompanied by quotations taken from the European discussers.

The evidence that has been presented to prove the etiologic relation of dental affections to systemic disease is, in order of importance, circumstantial, experimental, statistical and outright garnished opinion. With the exception of the principal exponents of the last, who seldom need further evidence as proof, the most painstaking and convincing investigators have confined their studies to the first three classes of evidence.

CIRCUMSTANTIAL EVIDENCE

By far the greater part of all the evidence presented is an attempt to prove this relation by case history reports. In a study of these reports by scientifically trained observers, it is noted that important features of the observations have usually been omitted, such as definite diagnoses and the length of time following elimination of suspected teeth in which the patient remained well. Since many of the diseases described as being focal in origin are of the fluctuating type, there

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is no evidence submitted that there would not have been a favorable change even if no treatment had been administered. While much of this uncontrolled evidence is highly convincing, it still fails to prove definitely the correlation of the dental infection to the systemic disease.

EXPERIMENTAL EVIDENCE

Later in our investigations, it was believed that certain experimental evidence, coupled with the more circumstantial evidence, such as case history observations, might more definitely prove the correlations. Indeed, when dental infection was eliminated, as proved by laboratory cultures; immediate health improvement followed, and the psychologic element was ruled out as far as possible, this combination of evidence made the probable relation more convincing. The frequency with which there was recurrence, in even these better controlled cases, after a few months of temporary relief from the supposed secondary effect, made this evidence doubtful. The inconsistency of results when patients with identical clinical pictures had all the teeth extracted added still more confusion.

Another experimental study which offered us more definite proof concerned the organ virulence theory of Eisenberg. This theory, although not generally accepted, has recently gained in adherents both in the United States and in Europe. It has more recently been revived and popularized by E. C. Rosenow and Frank Billings as the elective localization theory, with which you are all familiar; i.e., the theory that, by the intravenous inoculation of laboratory animals, in a large percentage of cases lesions similar and in location identical to those of the patient from whom the culture was taken may be produced. Many bacteriologists have failed to get a high percentage of specific localization. The frequency of nonspecific foci in the inoculated animals, the large doses injected and the spontaneous lesions so frequently observed even in the control animals have, in the minds of many exacting investigators, thrown doubt on this work.

The Europeans, as a rule, have been skeptical of what many spoke of as the "excessive claims" of Rosenow and his school, but, from the recent literature, it is evident that, in France, Germany, Norway and Sweden, renewed investigations are in progress which, from preliminary reports, would indicate wider acceptance of its possibilities, at least in the above mentioned countries.

Two French investigators, Sedallion and Nicolaw, recently reported an experiment substantiating Rosenow's theory to a certain extent and demonstrating tropism or elective adaptation more definitely. The authors conclude that next to the quantitative virulence and receptivity of the animals to infection by a germ, it seems that one should take greater account of the acquired and transitory tissue adaptation of the virulent germ.

Forssner's evidence as presented for kidney tissue by strains of streptococci, and Schmitz,' who long ago reported adaptations to muscular tissues by certain strains of staphylococci, are again being reviewed and studied by many pathologists. The inadequate method of definite classification of strains, the enormous invasive powers of streptococci and the fact that one can seldom prove which of these infections is the primary focus again leaves us without complete proof.

STATISTICAL EVIDENCE

Perhaps none of the evidence presented here has been followed with such contradictory results. From statistics com-

piled by the United States War Department publication "Defects Found in Drafted Men," some observers noted a much higher incidence of probable secondary effect in regions where defective teeth were most prevalent than in those showing fewer defective teeth. Dr. Appleton, considering the other possible cephalic foci, and using the compilation of medical examinations from more than one half of the recruits of the American forces, failed to observe such correlation. Dr. Appleton's study was more nearly in accord with the data of Fraenkel. The latter used the statistics from 17,000 medical examinations of policy holders of the Metropolitan Life Insurance Company of New York City, comparing the general health data of those showing less evidence of possible dental infection with the data of those presenting greater evidence. He also came to the conclusion that the differences are negligible. The foregoing attempts at statistical proof are typical of many reports which present this type of evidence.

It appears, then, that statistics so far have failed to prove much for or against the evidence under consideration. In fact, statistics have their most rational dental use in prosthesis; for when patients with full dentures can accurately pronounce the word "statistics," the restoration may be considered successful.

Before proceeding to my personal review of the data, I shall quote extracts from a translation of a discussion of my paper delivered by Leon Frey, director of the Course in Stomatology, Faculty of Medicine, Paris. He says, in part:

> The more I study this problem, the more convinced I become of its complexities. There are some observations and experiences clearly positive, but many others that are negative or doubtful. . . . All of these observations, all of these experiences are evidently very impressive, and one understands the rapidly spreading vogue of the theory of focal infection with elective affinity.
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> But the critical mind awakens; it finds these observations less convincing, the experiences not positive. It was Schmitz who, in 1923, stated that in five cases of septicemia of dental origin, three presented no correlation between the apical focus and the blood culture. It was the same Dr. Schmitz who insisted on the fleetness of elective affinity and showed that it rapidly became lost through the culture of the stem microbes.
>
> Then there are the reports of the Congress of Bath, in 1925, whose most careful researches remained negative. For the most part in rheumatism cases, no septic focus could be discovered. It was found that a number were carriers of dental infection which was old, but they never had presented rheumatic symptoms or manifestations. Finally, many times, these cases followed a rapid course in spite of the elimination of all septic foci; conclusions which were confirmed in a general way by Weissenbach and Francoinen in 1929.
>
> It was Kritchewsky and Seguin who, in 1925, in their researches at the Pasteur Institute on chronic infections of the pulp and apex, proved the polymorphism of the virulent streptococcus, insisted on the character of the microbe habitually residing in the rabbit and proved finally the frequence of acidophilus and antagonistic acidogenes of the germs of the streptococcic type. These conclusions were confirmed by Delater in 1926.
>
> Bara, in 1926, in his contribution to bacteriologic study of paradental granuloma, insisted that the vitality of germs was very feeble and their virulence very much reduced. Grandclaude of Lesbre, in 1926, arrived at the same conclusion.
>
> There are finally the French gastrologists who came to believe in the specificity of a gastric streptococcus, admitting only that the necrotic process was the initial lesions of the ulcer and regarding the infectious process as secondary. Thus, against the many facts positively established in the most eloquent, precise and scientific manner, there are still many facts negative or doubtful. It is why I remain perplexed, with you.

My report would be incomplete did I not call attention to the recent publication of the first volume of "Mouth In-

fections and Their Relation to Systemic Diseases," by MacNevin and Vaughan. This is the most comprehensive work of its kind ever undertaken in the English language. The authors state that they and their associates have reviewed many thousands of manuscripts dealing with the subject and regret that, in their melting pot, the views and opinions of many more writers could not be included. The bibliography contains the names of approximately 1,800 investigators, many of whom are quoted several times in the report. The work begins with a historical review of mouth infections of animals as geologically recorded long before the advent of man. We then have the historical record of the subject from the early Chinese folk lore and the teachings of Hippocrates to the present time. Following this are chapters devoted to a discussion of the evidence of oral infection with special reference to their etiologic relation to diseases of the eye, ear, circulatory and digestive systems, arthritis and other less well-defined pathologic conditions.

This work was made possible by the memorial which was established to Mr. Joseph Purcell, who died as a result of an obscure mouth infection. One is impressed by the sincerity of the authors, since the conditions under which the investigation was authorized might, quite understandingly, have fogged their vision. The reader is almost startled by conclusions such as the following:

> In a clinical review of the evidence supporting the oral focal infection idea, one is impressed with the limitations of every type of evidence submitted. It leaves one with the feeling that probably everybody contributing to the theory has been mistaken and that perhaps the idea at the bottom is unsound. In pursuing the matter to a logical conclusion, one must admit that the proof submitted is not altogether conclusive.

Since the pulpless tooth has been the most condemned single focus of all dental infections, the last paragraph of this volume should be of interest to those who never lost faith in root canal therapy. The authors say:

> As a result of painstaking research, many myths concerning the pulpless tooth have been exploded. An attitude of over-emphasis of the infection and under-emphasis of the efficacy of root canal therapy has been reversed and a more conservative attitude towards the pulpless tooth is everywhere apparent.

My extensive personal review of the data as recorded in the literature leads me to about the same conclusions as those reported by MacNevin and Vaughan. The mass of evidence indicating an etiologic relationship between oral infection and systemic disease, while in many instances highly convincing, is still far from final proof.

At the present time, there are fortunately many painstaking observers who, at one time or another, held views at one or both extremes but have studied the problem long enough to appreciate the fallacies of both extremes, and have arrived at a rational mean. As an illustration of this recent wholesome tendency, we quote from several of the most colorful observers whose early reports did much to encourage radicalism, probably more so than the authors desired. In a recent contribution, Thomas B. Hartzell says:

> It has been a matter of regret to me that when I was studying the problem of the pulpless tooth and apical dental infection in 1912, 1913 and 1914, which study so definitely proved to my mind that there radiated from diseased teeth infections which caused heart, joint and kidney disease which sacrificed many lives, that we had not also initiated an equally intensive study of how to overcome conditions which made possible the radiation from diseased teeth of the disease-producing germs which shorten human life. If such a study had then been made and given to the dental profession, the wave of fear which

impelled men to adopt radical treatment of all diseased teeth would have been prevented and thousands of individuals whose teeth were sacrificed would have been thereby made happier.

I do not in any way minimize the damage that arises from the diffusion of infections from diseased teeth. In fact, I shall show you this evening a few pictures, now principally of historical value . . . which did so much to initiate the tooth destruction measures which held sway for the next dozen years. And it seems to me that we who still practice dentistry owe a debt of gratitude to the men who created and practiced sane, constructive, aseptic dentistry, who had the courage to continue in their endeavors to save diseased teeth in spite of the heavy indictment which the research of those days definitely proved to be true.

Another illustration of this changing view may be found in a quotation from Howard R. Raper, who says:

In 1913, it is true that, compared to the aggregate opinion of the profession, I was a radical. In 1919, it is true that, compared to the aggregate opinion of the profession, I was a conservative. And it is true that, in 1923, I commence again to take on the aspect of a radical.

PERSONAL OBSERVATIONS

Details of our experiments have been frequently published and will be given here only in summary. Practically all cultures made from the apices of pulpless teeth of the atrophic hyperstreptococcic susceptible types of patients proved positive. These organisms, regardless of types of strains, usually had a higher virulence for laboratory animals than those taken from the pulp canals of other types of patients. The extraction of these teeth is seldom followed, for obvious reasons, by notable and permanent amelioration of the suspected systemic disease.

While the percentage of demonstrable positive cultures taken from the teeth of chronic arthritics, hypertrophic types, is lower, the extraction of all such infected teeth is frequently followed by temporary and sometimes by permanent relief. There may be no correlation, but in the majority of the cases showing improvement, the patient died within ten years from one or another of the degenerative diseases.

THE INFECTED DEGENERATING VITAL PULP

When teeth having an infected degenerating vital pulp are definitely located and treated, the immediate response and the phenomenal relief from the acute secondary effects are frequently more definite than those following the elimination of pulpless teeth. In these immediate responses, toxins and allergy may play an important part. We have observed that, when all other foci have been eliminated, the percentage of permanent recoveries is higher in the patients who have had all teeth extracted than it is when only the pulpless teeth are eliminated. We believe this to be due to the removal of all vital pulp infection. Those of you who keep accurate records should test this statement. We are not advising the extraction of all teeth in case of suspected secondary effects. We are only insisting that these teeth be located and be either treated or extracted. Only a small part of our profession is as yet aware of the significance of these foci. These cases of degeneration are usually due to trauma from various types of restoration. It is evident that the too deep and extensive cavity preparations advocated a generation ago should be discontinued. The infected degenerating vital pulps are mentioned here because the etiologic relation between infected teeth and systemic disease is far more definite and easy to demonstrate in vital pulp infection than it is in the presence of pulpless teeth. In the most striking cases of elective localization that we have

seen the cultures were from infected vital pulps.

GENERAL OBSERVATIONS

Down through the centuries, an accumulation of evidence has come to us indicating an association of systemic disease and dental conditions. It is not at all probable, and scarcely possible, that all writers on this subject could have been wrong. It was not until our own generation that a few assiduous observers, such as Hunter, Mayo, Billings, Rosenow and Price, succeeded in impressing the profession with the gravity of the relationship. The new conception captured the imagination of American dentists at a psychologic moment, when the narrowness of their field was beginning to oppress them. With the new interest, the profession was soon bubbling over with enthusiasm for the broadening of their outlook and the extension of their services. The possibilities in this new field of investigation were so promising that many men not suited to research either temperamentally or by training undertook the work. The first reports represented all shades and degrees of opinions from the ultraconservative to the ultraradical. The practitioners could resort to radicalism or conservatism of any degree and find justification for their methods in the literature.

CONCLUSIONS

Time has permitted only a digest of the present conception of the significance of dental infection in systemic disease as determined from an extensive review of the literature. No attempt has been made to credit the reports of many of the outstanding contributions as published in the several languages. Volumes would be required to do this. Those interested in the more complete details and bibliographies, I again refer to the published reports of Schottmüller, Christ, and MacNevin and Vaughan. A study of the problem indicates a tendency of American research reports toward becoming more conservative in substance, on the one hand, and a greater appreciation on the part of many European workers of the soundness of some of the focal infection principles as determined by American investigations on the other.

American research workers are just beginning to appreciate the splendid influence which the several European investigators who are now working in one of our institutions have had on dental research and which may aid us in more rapidly solving this problem. The influence of Dr. Orban and Dr. Kronfeld, from the Gottlieb laboratories of Vienna, while working in the Chicago College of Dental Surgery, has been most stimulating not only in Chicago but also throughout the central part of the United States.

There are a number of obscure, complex factors which enter into the focal infection question, such as intoxication, allergy, variations in biologic constitutions of individuals, etc. It is because of these that the problem is still to be definitely solved. While the focal infection theory is still unproved, it has been carried to a point where it serves, when applied by a competent internist, as a working hypothesis in the diagnosis of a number of important infectious diseases.

With a better understanding of certain of the associated influences, with the more adequately controlled and directed research of the present time, and the greater cooperation of the workers which has been made possible by the International Association for Dental Research, we have reason to anticipate more rapid progress in the solution of this complicated problem.

PULP ABSCESSES AND ROOT RESECTION*

By EDWARD H. HATTON, B.L., M.D., Chicago, Ill.

PULPAL ABSCESSES

PULP abscesses of teeth are conveniently divided into two groups: an open form associated with extensive decay, and consequently opening freely into the mouth cavity, and a closed form found either under large inlays, fillings or crowns or beneath a type of untreated caries characterized by slight superficial and extensive deep involvement. A further division into acute and chronic types is frequently made, but since these two forms shade into each other and vary from time to time even in the same tooth, this division has only minor significance. In this discussion, the term "abscess" will be limited to those cases in which pus can be demonstrated, although pus production varies markedly from time to time in the life history of these lesions.

Although, as has been suggested, the form of the open type varies greatly, there are a number of common characteristics, such as relatively rapid destruction of all of the pulp tissue, the presence of abundant pus, early involvement of the apical region, freedom from the higher grades of pain and tenderness and, because of the ready discharge of pus and necrotic tissue into the mouth, comparatively little danger that the lesion may be a primary focus of infection. In children and young people this type of pulp abscess sometimes assumes characteristics which relate it to the second type. Pus is scanty or nearly absent; granulation tissue is very abundant and may be covered with epithelium; the process in the pulp is often sharply circumscribed by connective tissue bands which may be calcified; the apex of the tooth is involved quite late, and, finally, such a lesion must be considered as a possible focus of infection, even though the apex is not the site of any change that may be recorded in the roentgenogram. The condition just described is commonly called hypertrophy of the pulp, although this is not a particularly happy choice of name.

It would seem that there is no reason for a further elaboration of the description of the first form, since this statement includes reference to all of the features that may be of importance in diagnosis and treatment with reference to root-canal therapy. Obviously, this form is easily recognized even on superficial examination. Because of its relatively rapid progress, early involvement of the apical space is to be expected and the findings of the roentgenogram are decidedly discounted. From the standpoint of focal infection, conservative methods of treatment are to be favored, although the process at the apex may have advanced to such a degree as to warrant nothing but extraction. This situation has some of the features of a paradox. Often because of the mildness of the objective symptoms, the dentist will not see the patient until the condition of the tooth and

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the apical region does not warrant its retention.

The second or closed form has rather contradictory characteristics, such as very slow progress, a marked tendency to remain circumbscribed for a long time, very late and slight involvement of the apical region and either entire absence of pain and tenderness or marked variations in the character and location of this symptom. If pain is present, it appears relatively late and may have periods of fluctuation, eventually reaching a peak which may demand immediate relief. Such a lesion has all of the attributes necessary for a primary focus of infection, and, as a rule, cannot be demonstrated by roentgenographic examination. Just why such pulp abscesses develop slowly and remain circumbscribed and dormant for months or longer is not absolutely clear. Two reasons are suggested: 1. The ingress of bacteria into the pulp is relatively slow, and therefore one of the features of successful bacterial invasion is partly nullified; that is, the introduction of relatively massive doses of bacteria within a comparatively short time. 2. The type of the organism that persists in the dentin is more of a saprophyte than a parasite, and therefore, while for it existence in zones of damaged or dead dentin is favored, the environment in the adjacent pulp is not so suitable for its growth and extension. Nor is it clear why it flares up suddenly, produces intense symptoms and has a tendency to spread into adjacent structures. It is possible that new organisms may be introduced into this circumscribed region from other parts of the body by way of the blood stream or through lymph channels.

This form offers difficulties in diagnosis because of (1) the absence of symptoms in many cases, (2) the contradictory character of symptoms if present and (3) the fact that the roentgenographic film is usually negative. In the first place, such a lesion is likely to be overlooked in the search for a primary focus of infection. At the present time, pulpless teeth are always under suspicion, but teeth carrying inlays, excellent amalgam fillings or satisfactory crowns are rarely suspected of being hazards to health. In the second place, pain, if present, is likely to be referred to another tooth or to another part of the jaw. An unusual but suggestive illustration of this peculiarity was found in the mouth of a young woman who complained of extreme pain in the upper bicuspid region. She had an upper bicuspid which was pulpless and which, naturally, was immediately suspected. Everything was done, except extraction of the tooth, to relieve her pain, but after she had passed two sleepless nights, both the patient and her dentist were desperate and then only were her other teeth given careful consideration. A lower bicuspid carried a moderately large gold inlay. As this was on the same side of the jaw and not entirely normal in its reactions to tests, the inlay was removed and the pulp opened. Pus in abundance and appearing to be under pressure was disclosed. There was complete relief of the symptoms. The baffling element in this case, of course, is the reference of the pain to the upper jaw rather than to the lower.

Pulp abscesses occur less frequently than death of the pulp, but it must be clear that where there are large fillings or crowns over presumably vital, healthy pulps and pulpless teeth in the same mouth, this diagnostic difficulty must always exist and should have ample consideration. Many dentists are already aware of the necessity for this form of discrimination, but few physicians appreciate the possibility of danger from such

teeth. From the standpoint of pulp canal therapy, it would seem that such teeth offer an excellent prognosis; but treatment involves the solution of two moderately difficult problems. In the first place, it must be so managed that the apical space is not infected. In the second place, access to one or more of the canals of the roots is likely to be very difficult. This portion of the root canal is quite certain to be reduced in diameter by deposits of secondary dentin, and portions of the pulp are often the site of extensive calcification.

Such conditions, of course, are almost entirely confined to bicuspids and molars. They are, presumably, less common in such teeth as the upper first molar, where one canal is quite large and the remainder are small. In such teeth, the infectious process is likely to have an early extension into the apical space through the relatively large canal. The infection does not spread by direct extension, but seems to jump from spot to spot to form a chainlike group of tiny abscesses from the canal origin in the crown to the apex. In working on such teeth, it is worth while to remember these facts and also the fact that the larger canal is likely to contain the greatest amount of putrescent material. On this account, it would seem wise to begin with the most accessible and the largest canal and make an effort to sterilize it before opening the smaller, less accessible canals.

What has been said about pulp abscesses under large fillings or crowns applies equally well to the management of cases of hypertrophy of the pulp or of pulp abscesses where the pulp exposure is relatively slight, such as extensive caries of the dentin beginning in a deep pit and with relatively little enamel involvement. Since pulp hypertrophy is more common in children, even in deciduous teeth the possible connection of this condition with a secondary infection should not be overlooked. Indeed the more one studies the pathology of the pulp, the more evident becomes the necessity for intelligent and painstaking care of children's teeth.

Abscesses occurring under large fillings or crowns are relatively rare, but are the source of rather unusual and complicated diagnostic and therapeutic problems. (This statement has been described by critics as entirely too conservative. Clinicians who are handling much more material than I seem confident that this condition is not relatively rare but only seems so because it is so seldom identified.) On the other hand, abscesses associated with caries and free exposure of the pulp are much more common and offer few difficult problems in diagnosis and treatment.

ROOT RESECTION

The problems involved in root resection do not seem to be so simple as might be expected from the discussions of either its proponents or its opponents. If this is accepted as true, it serves to explain the contradictory character of the results obtained and evaluated from either point of view. The successes seem to be either greater or smaller than they should be to satisfy the theories of either group. There are probably not less than three factors in the production of a successful result, namely, the elimination of infection or inflammation, the satisfactory anatomic adjustment of the structures about the apex and control of the local osteogenic process. There may be others, but it would appear that these are the most important.

Most of the discussions and experiments have been concerned with the elimination of infection and inflammation, biased by the belief, apparently, that this

is the only problem to be solved. Because this phase of the problem has had such thorough discussion, little can be added. One can merely admit that the elimination of infection is important, for if it is not carried out, the operation is doomed to certain failure. The elimination of infection can be no more difficult than in any other form of surgery or pulp canal therapy. Indeed, the combination of the two steps in the procedure would seem to simplify the problem, because each step is complementary to the other. The percentage of failures should, therefore, be no higher than in any other form of pulp canal therapy. One is forced to assume that there must be other factors concerned since failures are greater than should be expected from the complication of infection alone. The following discussion is limited to a consideration of other possible factors that may have to do with success or failure.

From the mechanical and anatomic point of view, only two points have received much consideration. The first has to do with the proper selection of teeth to be treated. The second is concerned with the careful completion of the tooth surface exposed by resection so that roughness and irritating margins shall be wholly eliminated. But little, if any, attention has been paid to anatomic relationships of the tooth and bone or to the changes that have arisen from the pathologic conditions at the apex, which antedate the operation.

In the first place, the bone structures around the apices of teeth selected for operation differ markedly in different mouths and even in the same mouth. This is particularly true as far as they have to do with the relationship of the apex of the tooth to the buccal or lingual plate of bone. In a large percentage of cases, this plate of bone over the apex is extremely thin or even entirely absent. Where such defects occur, they vary in diameter from a fraction of a millimeter to several millimeters. Just what effect this may produce may be determined only by careful experimentation and observation, but it seems fair to assume that the presence of such a defect favors the prognosis. The reasons for this conclusion are three: 1. The loss of this support to the apex, if it has been in existence for some time, has received adequate compensation by thickening of the bone plate elsewhere, and thus the sudden loss of the tooth apex and the adjacent buccal bone does not materially change the anatomic support of the tooth in its socket. Provision has already been made for such a new situation. 2. In the development of the changes at the apex following infection, this defect acts as a safety valve, and the changes develop more rapidly about the buccal or labial aspect of the apex than about the lingual portion, and thus the bone is retained to a greater degree in the latter location. 3. Surgical access to the apical space is gained with less destruction of bone and surrounding structures, if there is already a bone defect present.

A further item in the problem which is more or less mechanical or anatomic has to do with changes in the periodontal membrane that are difficult to estimate from inspection, some form of palpation or from the roentgenogram. Since the deterioration of the periodontal membrane advances more rapidly in that portion midway between the tooth and the bone, it is, as has been said, difficult to determine whether the resection has been carried into healthy structures. In other words, it is relatively much simpler to arrive at a just estimate of the condition of the tooth substance and of the bone than an estimate of that of the soft tis-

sues. Other matters have some effect on the result, such as the length of the root and the strength, height and thickness of the bone plates at the alveolar crest, as well as the character of the occlusion. It is my impression that some cases of failure in this operation may be explained as mechanical. There may be a serious lack of coordination between the forces that are brought to bear on the crown of the tooth and its relatively new position in the socket after surgical removal of the apex.

It must be granted that part of the foregoing is speculative and theoretical, and it is offered not as a proven fact, but as a basis for further study and experimentation.

Concerning the control of the osteogenic process, not much is known and there is still room for much work in this field. The earlier studies that were made of resected teeth by histologic methods seemed to indicate that repair, particularly of the dentin surface exposed by the operation, was far from adequate. This is not to be accepted as final. Coolidge has reported a case recently in which bone repair and the deposition of new cementum on the exposed dentin was complete. This case is not unique and, in addition, instances of cemental repair following injury in the apical region have been reported a number of times in the last year or two.

As it is reasonable to believe that healing can occur, it is now largely a question of how to provoke a favorable reaction. The situation is virtually the same as in bone repair following injury, whether the cause is accidental or surgical. It is fair to assume that the same factors are involved. The age and physical condition of the subject, no doubt, have much to do with the result. In part, it may be a matter of the control of mineral metabolism, a subject about which we know too little and only just enough to expect entirely too much of the therapeutic measures now available.

It may be concluded that root resection is a useful operation which should not be discarded, provided careful attention be paid to all the conditions that control the final result.

REACTION OF DOG TISSUE TO DRUGS USED IN ROOT CANAL TREATMENT*

By EDGAR D. COOLIDGE, D.D.S., M.S., Chicago, Ill.

THIS paper is a preliminary report of an investigation of the reaction of the periapical tissues of dogs' teeth when the living pulps were removed and drugs sealed in the root canals for a period of twenty-one days. The results show that all the drugs used are irritants to healthy connective tissue in dogs. Some drugs caused more irritation than others, which was attributed largely to their properties of penetration. Those drugs that have the properties of coagulating albumin appeared to be self-limiting in their action and did not penetrate deeply; therefore, less destruction of living tissue was found about the root apices when these drugs were sealed in the root canals of the dogs.

CONTROL CASES

In several cases, after pulp removal, the cavity was sealed, an empty canal being left beneath the filling. (Fig. 2.) A reactive periapical inflammation followed the pulp removal, during which exudate and dead cells accumulated in the canal. Because of the nature of the enclosure, there was not sufficient circulation to remove this stagnant degenerating material, which became a continuous source of irritation to the periapical tissues, and the area of infiltration continually increased. Whether micro-organisms entered the canal and infected the contents it is difficult to say. All controls of this type gave a similar picture, with a slight variation in the size of the area involved.

Root canals from which the pulp was removed and in which a moist dressing of sterile water or a sterile normal saline solution was sealed gave a much greater reaction as regards the periapical tissues. (Fig. 4.) These liquids, having filled the canal, perhaps hastened the process of infiltration of the periapical tissues with leukocytes by providing a medium for the transfer of irritating material from the canal outward. Decomposed cells from remaining shreds of the pulp stump and leukocytic débris and serum might be factors in producing the violent reaction seen at these root apices.

One control of a 1/100 normal sodium hydroxid solution (Fig. 16) was used and a very mild reaction appeared at the root end. A large remnant was found in the apical third of the root end, which probably had some retarding effect upon the drug's action and its escape to the periapical tissue. The periapical tissues presented a small degree of leukocytic infiltration. It may also be possible that the other controls were infected acci-

*Read before the Section on Operative Dentistry, Materia Medica and Therapeutics at the Seventy-Third Annual Session of the American Dental Association, Memphis, Tenn., Oct. 20, 1931.

*Investigation started in the Research Department of Northwestern University Dental School and continued in the Research Department of Chicago College of Dental Surgery, Dental Department of Loyola University, with the assistance of Drs. Hatton, Skillen, Benedict, Fink, Orban and Kronfeld of the two schools and Dr. Paul Nicholas Leech of the American Medical Association.

dentally, while the sodium hydroxid possibly prevented infection.

ESSENTIAL OILS

Of essential oils tested, oil of cloves (Fig. 6) seemed to produce the least irritation. Eugenol (Fig. 7) produced very extensive leukocytic infiltration with bone resorption. This reaction to eugenol corresponds to the report of Luthi[1] from the laboratory of O. Mueller, and of Feldman,[2] who also found large areas of tissue destruction about dog's teeth when this drug was sealed in the root canals. Eucalyptol (Fig. 8) provoked a reaction similar to that of eugenol. The cells were largely leukocytes, but there were also many lymphocytes and plasma cells present.

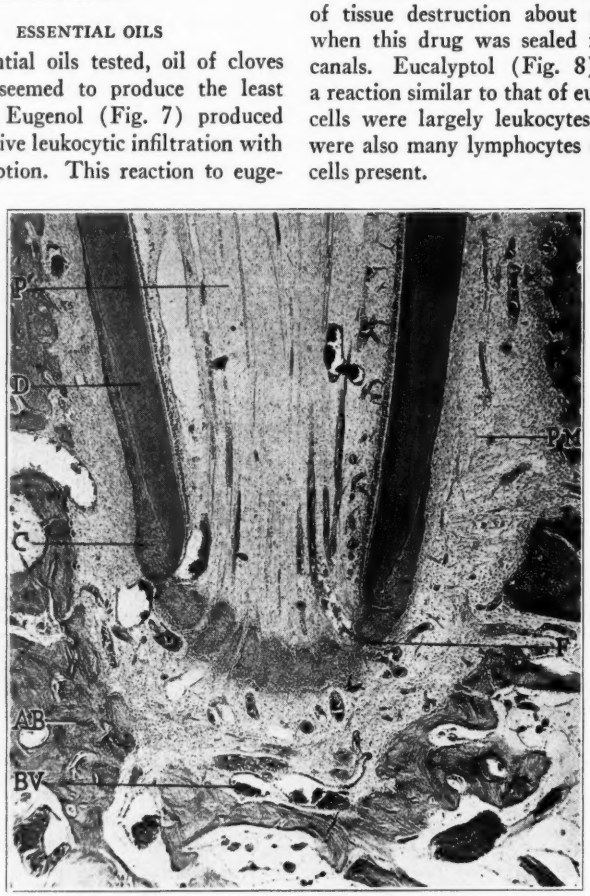

Fig. 1.—Apical third of incisor tooth of young dog with normal pulp and periodontal tissue. *P*, pulp. *D*, dentin. *C*, cementum. The apex is closed by cementum instead of by dentin. (In human teeth, the apex of the root is formed by dentin.) *F*, foramen opening through the cementum. *PM*, periodontal membrane. *B*, alveolar bone. *BV*, blood vessels.

PHENOLS, CRESOLS AND FORMALIN

Phenol, cresol, cresote and cresatin

1. Luthi, H. R.: Ueber den Einflus von Chlorphenol, Phenol, Tricresol-Formalin, Trio paste, Albrechtsche Wurzel fühlung und Eugenol auf des Periodontium, Vierteljarschr. f. Zahnhlk., 1928, No. 1.

2. Feldman, G.: Experimental Investigation on Action of Thymol, Eugenol and Decomposition Products of Pulp on Peridental Membrane, Deutsch. Monatschr. f. Zahnhlk., 1927.

were tested. Phenol (Fig. 9) produced a dense plug of necrotic tissue. In one case, the plug extended into the periapical region with a well-defined outline surrounded by thickened connective tissue like a capsule. In Figure 10, the mild localized reaction to cresol is shown. The employment of cresatin (meta cresol acetate) (Fig. 11) resulted in a more widely spread cellular infiltration than S.T. 37, a resorcinol base to which six methyl groups ($C_6H_3.[OH]_2.C_6H_{13}$) are attached, caused a very extensive infiltration of polymorphonuclear leukocytes. The extent of the area and the intensity of the reaction indicate that this is a deeply penetrating drug that does not coagulate albumen.

The use of formalin (Fig. 12) caused considerable infiltration in the periapical

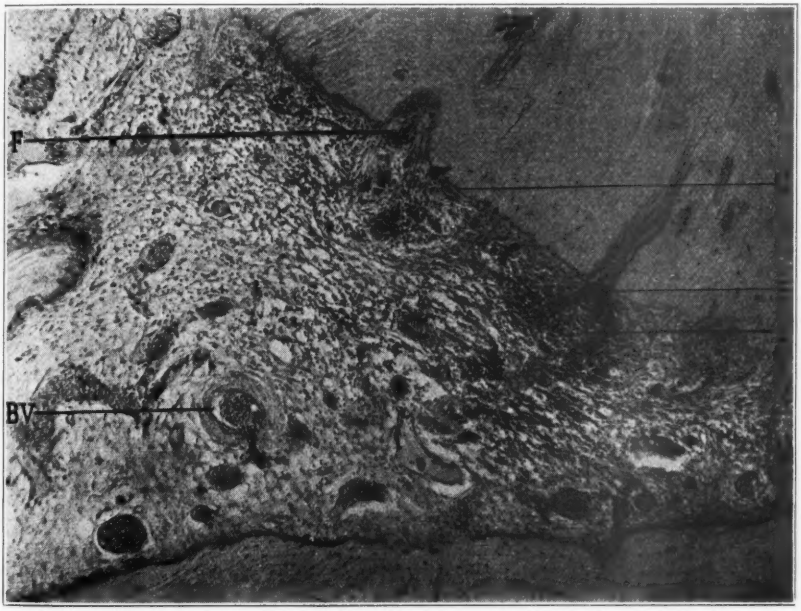

Fig. 2.— Apex of incisor of dog from which pulp was removed. The tooth was sealed up without any drug dressing. *C*, cementum. *F*, foramen. *I*, infiltration of a mild character in the periapical tissue. *BV*, blood vessel. Very little tissue reaction is in evidence.

did the use of cresol and creosote, but no necrosis was evident as in the case of phenol. Cresatin belongs to the class of drugs that do not coagulate albumen. There was less evidence of a localization in its effect than with phenol and cresol.

The use of hexylresorcinol solution tissue in some cases, and in others (Fig. 13) seemed to so fix the pulp stump that the initial hemorrhage resulting from the severing of the pulp in its removal remained unchanged after twenty-one days. The red corpuscles appear throughout the remaining pulp stump like a very

recent hemorrhage, although no bleeding could have occurred except at the time of pulp removal. The reaction to formocresol (Fig. 14) was evidenced in a small localized coagulated area in the periapical tissue at the apical foramen with very little cellular infiltration.

sodium hydroxid solution were used. The tissue about the root apices where chloramin T (Fig. 15) was sealed reacted with a rather widely spread leukocytic infiltration, showing some breaking down. Chlorinated soda produced little effect on the periapical tissue. The reac-

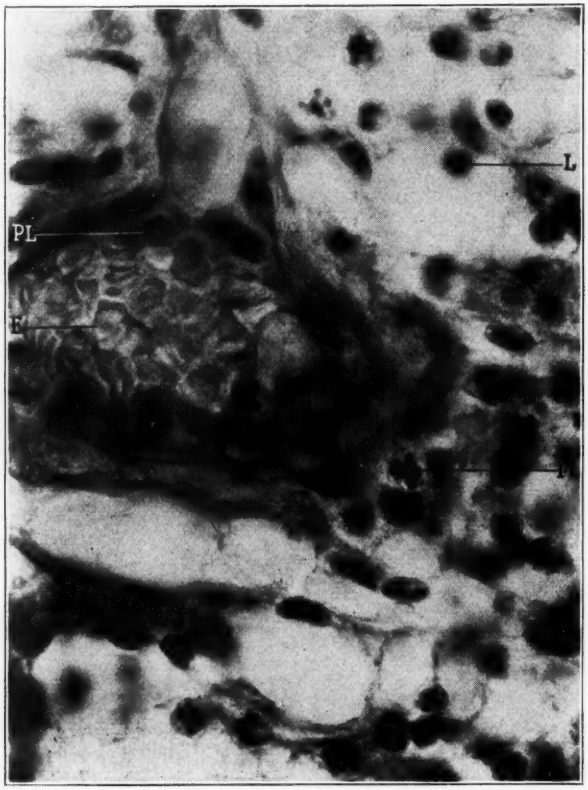

Fig. 3.—High magnification of blood vessel in Figure 2, showing typical mild inflammatory reaction. *E*, erythrocytes in vessel. *PL*, polymorphonuclear leukocytes. *L*, lymphocytes.

CHLORIN GROUP

A 4 per cent solution of chloramin T, chlorinated soda solution and another solution of equal parts of the 4 per cent chloramin T solution and 1/100 normal

tion about the roots containing equal parts of chloramin T solution and 1/100 normal sodium hydroxid solution (Fig. 17) was similar to that to the chloramin T alone, but less breaking down of the

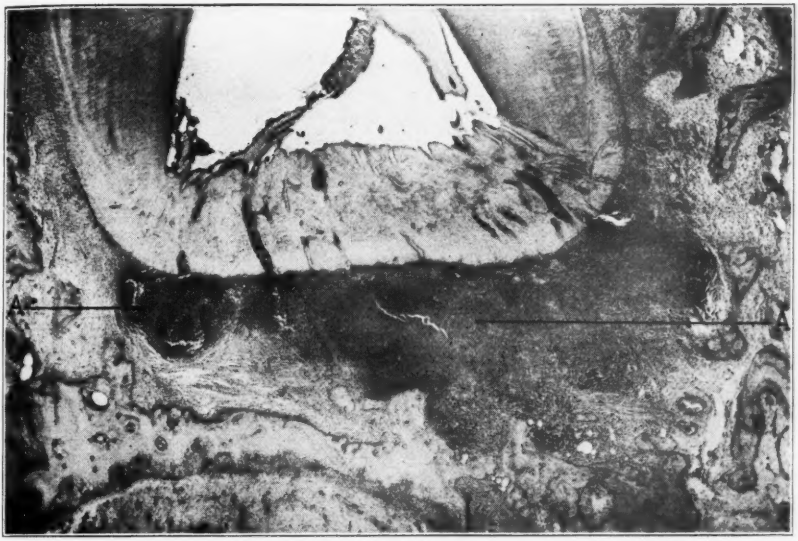

Fig. 4.—Apex of control tooth in which sodium chlorid solution was sealed. The violent tissue reaction is evidenced by the presence of polymorphonuclear leukocytes. *A*, abscess formation in periodontal membrane. Some resorption of the cementum has occurred.

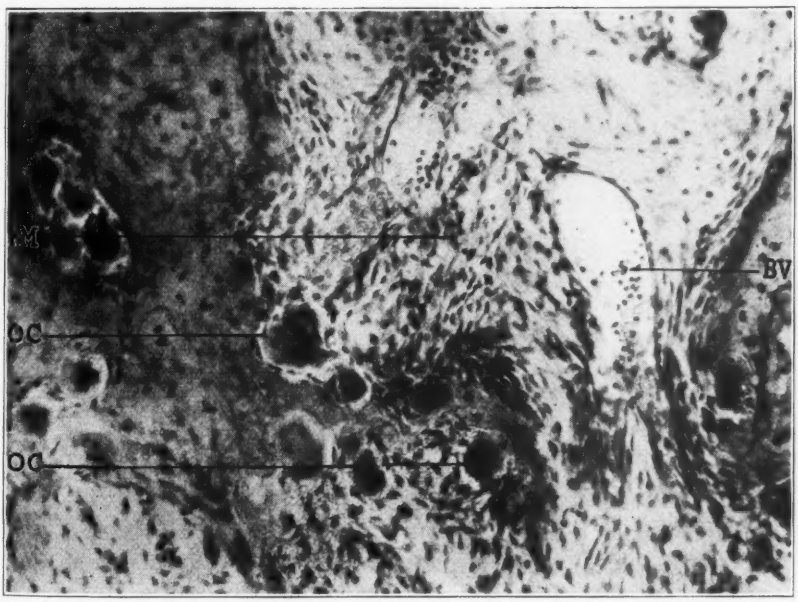

Fig. 5.—High magnification of area of Figure 4 in periphery of abscess showing developing acute osteitis. *BV*, blood vessels containing leukocytes. *FM*, fibrous marrow. *OC*, osteoclasts on bone surface.

tissue was evident and the marrow spaces were less affected.

COMMENT

Some of the conditions that affect the results obtained in this type of experiment should be mentioned here. The amount of pulp remnant being variable, its retarding effect on the drug sealed in the canal would vary in proportion. The size of the canals was not uniform; nor were the number, size and location of the foramina the same in all cases. The amount of the drug used could not be the same in each case and the degree of pressure placed on the drug when the tooth was sealed varied. In most cases, the drug was used in both upper and lower teeth in the same dog and in more than one dog to assure as fair a test as possible.

Living tissue reaction to a drug is considered to be a chemical reaction between the cell protoplasm and the substance introduced. This reaction is expressed as irritation. A mild irritation may involve only a few cells and the effect is frequently found to be an improvement of a local pathologic condition. A greater irritation may depress or change the cell function by causing too great an injury to the living cells. The basic law governing pharmacologic action as stated by Prinz[3] is that "drugs ingested into the body must be soluble in the tissue fluids in order to combine with the cell contents and thereby exercise their function." The reaction between the cell and the drug is a chemical

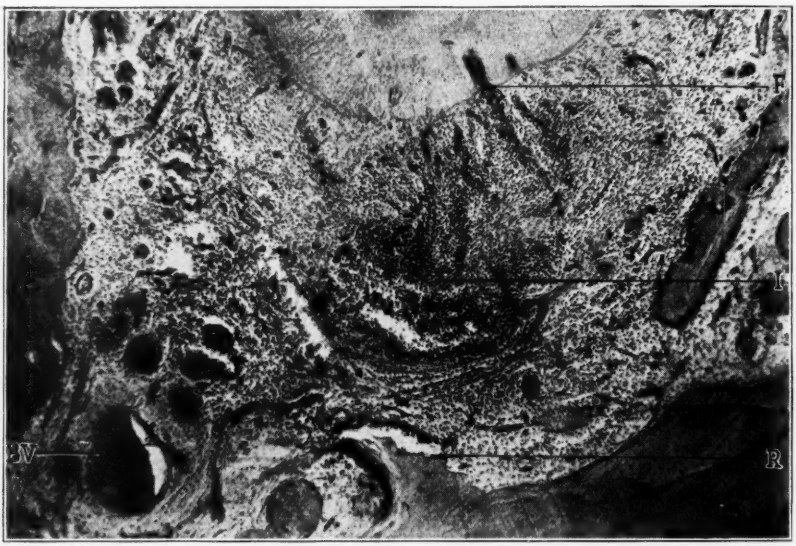

Fig. 6.—Cross-section of tissues in case in which oil of cloves was sealed in. *F*, foramen. *I*, area of infiltration in periodontal membrane, showing abscess formation. *BV*, enlarged blood vessels. *R*, resorption of alveolar bone.

3. Prinz, Hermann: Dental Materia Medica and Therapeutics, Ed. 6, St. Louis: C. V. Mosby Co., 1926.

Fig. 8.—Case in which eucalyptol was sealed in. *P*, small pulp remnant. There is very dense and widespread infiltration of periapical tissue. The center of the area is breaking down into pus. *A*, abscess. *B*, alveolar bone considerably resorbed enlarging the periapical space. The principal fibers of the periodontal tissue at the apex of the root have disappeared.

Fig. 7.—Case in which eugenol was sealed in. *F*, foramen containing necrotic pulp stump. *I*, extensive dense inflammatory infiltration. *R*, resorption of alveolar bone with osteoclasts lying in Howship's lacunae.

Fig. 9.—Case in which phenol, 95 per cent, was sealed in. *P*, coagulated pulp tissue at apex of root. *CT*, localized area of coagulated and necrotic periapical tissue. *F*, circular arrangement of fibrous tissue around coagulated area (perhaps capsule formation).

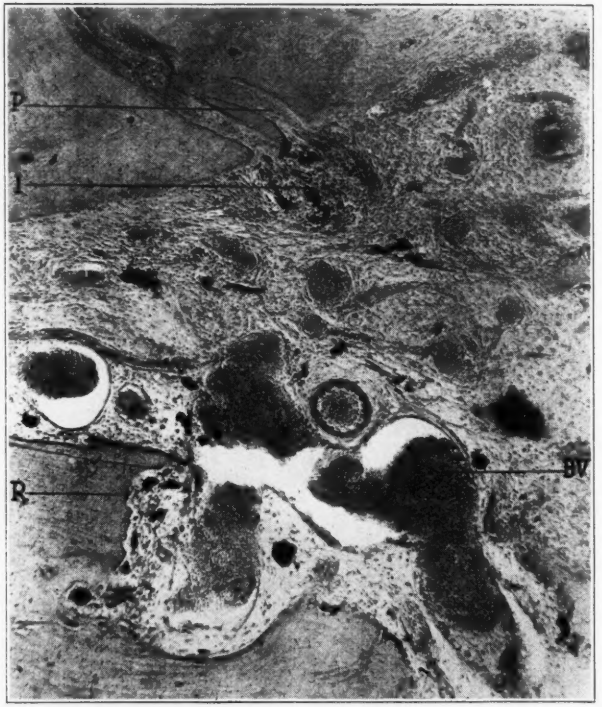

Fig. 10.—Case in which cresol was sealed in. *P*, pulp at apical foramen. *I*, localized area of infiltration, small and localized. *BV*, blood vessel considerably enlarged and filled with coagulated blood. It is not certain that the enlargement of the vessels is a reaction to the drug in the canal. The tissue of the periapical region shows only a mild reaction. *R*, resorption of alveolar bone.

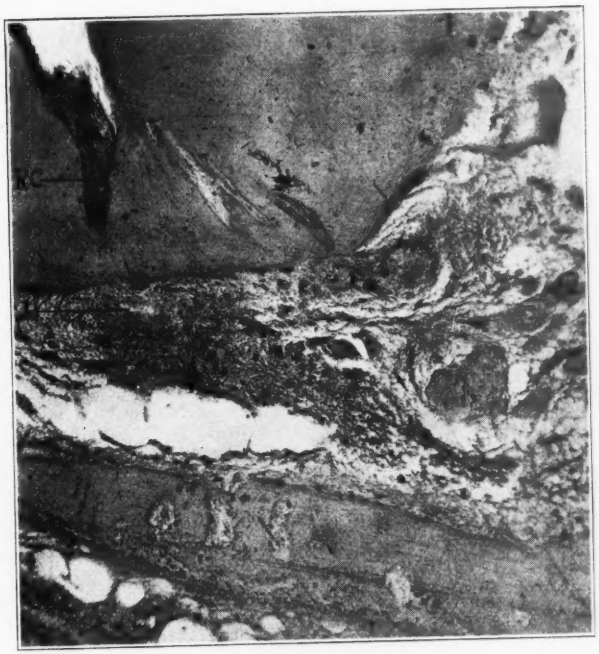

Fig. 11.—Case in which cresatin was sealed in. *RC*, root canal with pulp remnant. *I*, area of infiltration.

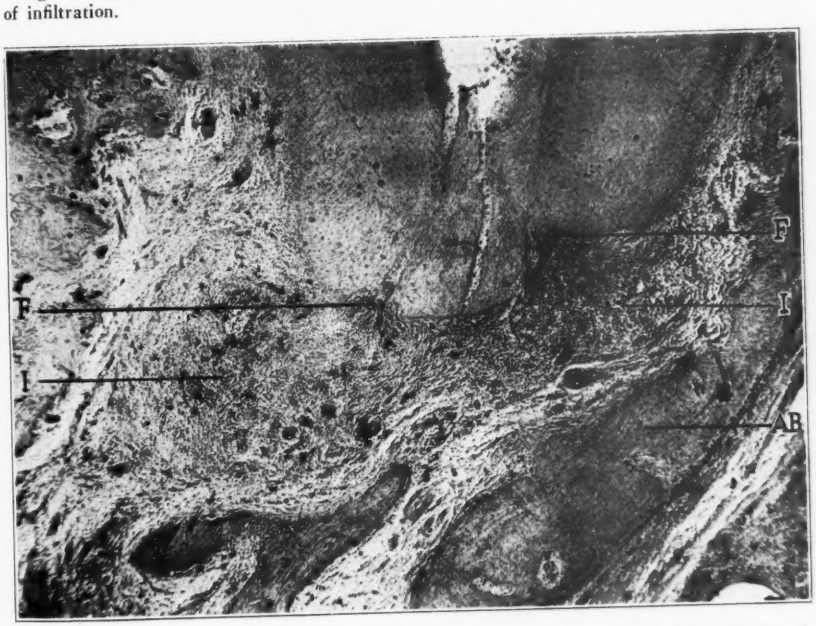

Fig. 12.—Case in which formalin was sealed in. *F*, apical foramen. *I*, diffuse leukocytic infiltration of periapical tissue. *AB*, alveolar bone.

the drug in the canal. The tissue of the periapical region shows only a mild reaction. *R*, resorption of alveolar bone.

mation).

combination between the albumin, lecithin, salts or water in the cell protoplasm. Those drugs classed as caustics destroy the cell by coagulation of its protein substance or by its dissolution; by oxidation, by abstracting water or by substituting new elements which entirely change the cell itself.

Wells[4] states that anything that interferes with the oxidative capacity of the cell acts as a poison and that "the combining of even one of the essential constituents of the cell may so upset the normal chemical processes that the cell no longer takes up substances to repair its waste and hence necrosis occurs." It has also been shown that, under the microscope, the cells subjected to mechanical injury appear to increase in the acid reaction of the tissue involved[5]. Also Wells states: "Aseptic softening in general may be safely ascribed to digestion of proteins by cellular enzymes, either from dead cells or from the leucocytes. Suppuration is merely a form of liquefactive necrosis and such digestion is particularly rapid because of the large numbers of leucocytes present."

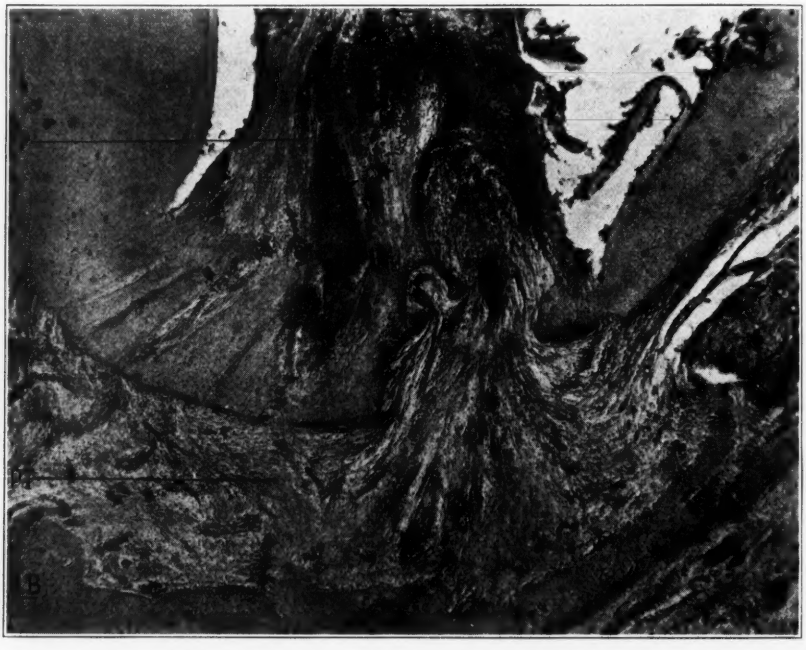

Fig. 13.—Case in which formalin was sealed in. *P*, pulp stump fixed by drug and still unchanged after twenty-one days. *PT*, periapical tissue at apical foramen showing very little change. *AB*, alveolar bone.

Drugs that are germicidal but are not

4. Wells H. G.: Chemical Pathology, Ed. 5, Philadelphia: W. B. Saunders Co., 1925, p. 426.

5. Chambers: Am. J. Physiol. Vol. 43, 1917.

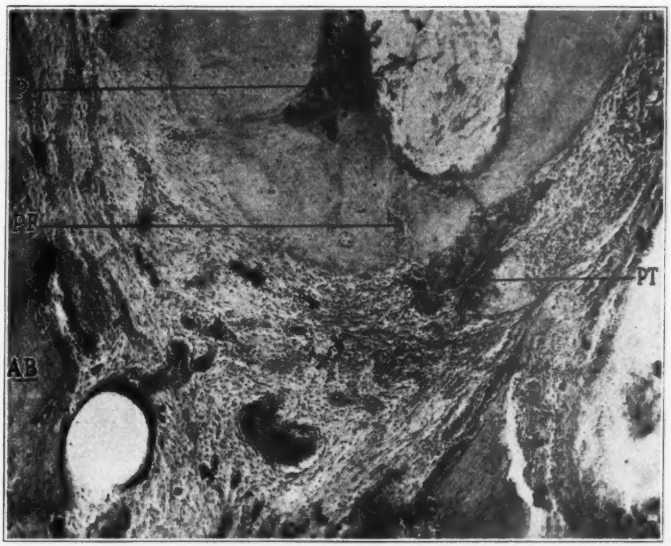

Fig. 14.—Case in which formocresol was sealed in. *P*, necrotic pulp remnant. *PF*, pulp in apical foramen. *PT*, periapical tissue showing small localized area of coagulated tissue; very little cellular infiltration. *AB*, alveolar bone.

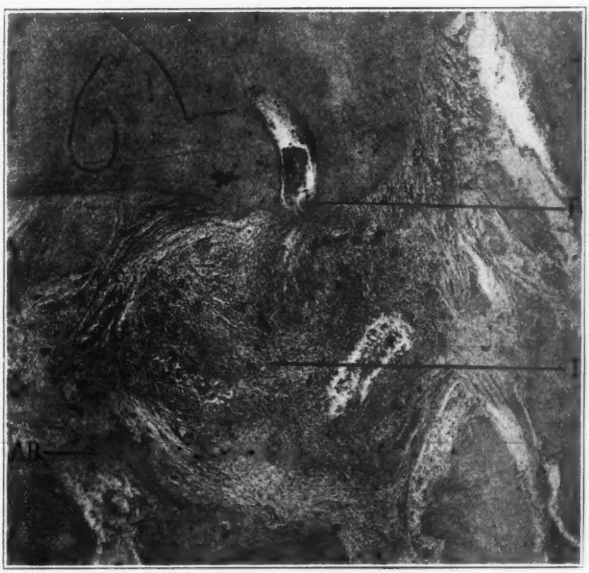

Fig. 15.—Case in which chlorazene (chloramin T) was sealed in. *F*, apical foramen. *I*, rather widely spread area of infiltration with some breaking down of tissue. *AB*, alveolar bone.

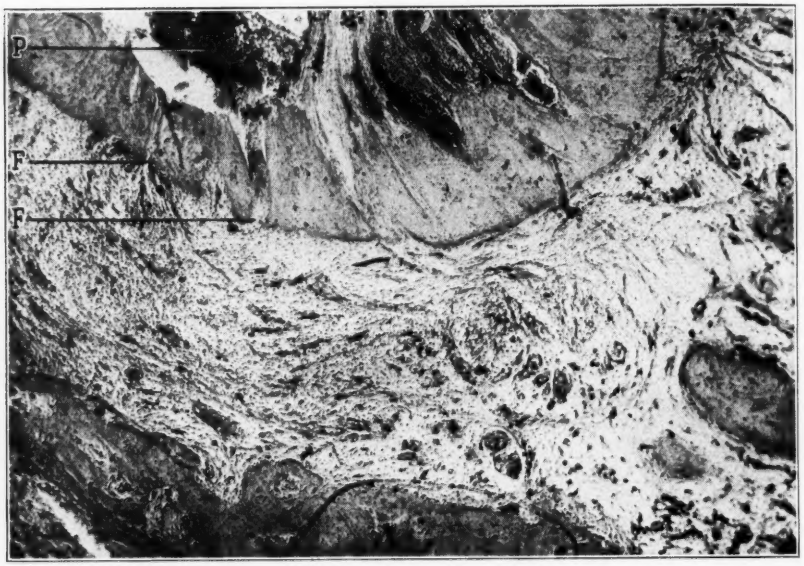

Fig. 16.—Case in which sodium hydroxid 1/100 normal solution was sealed in. *P*, necrotic pulp remnant. *F*, apical foramen. The periodontal tissue appears to be unchanged. Chloramin T alkalinized with sodium hydroxid 1/100 normal solution seemed to cause less reaction in the tissue than chloramin T alone (Fig. 15).

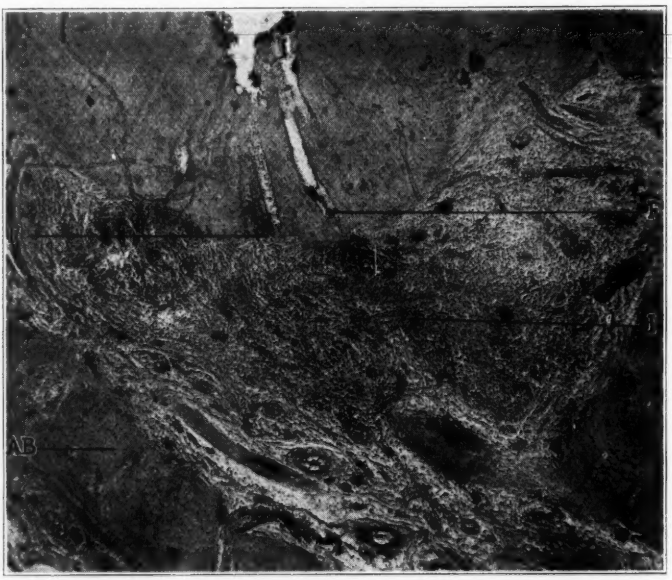

Fig. 17.—Case in which chloramin T alkalinized with sodium hydroxid 1/100 normal solution was sealed in. *F*, apical foramen. *I*, widely spread area of infiltration. *AB*, alveolar bone.

self-limiting by the coagulation of protein should not be looked on as harmless to living connective tissue. Their action is continuous until the drug itself becomes sufficiently combined or diluted to stop its action. They are probably more efficient for sterilization of inaccessible portions of an infected root canal. The protein coagulating drugs used did not penetrate so deeply into the living tissue as the noncoagulating type and the damage to the tissue was not so great as had been anticipated.

Drugs are usually sealed in human root canals because of their ability to destroy pathogenic micro-organisms, which are not only in the main canal, but may also be in all the ramifying collateral branches. The possibility of coagulating drugs reaching such inaccessible places when sealed in the main canal is more doubtful than when those drugs are used which possess greater properties of penetration. The drugs used for medication in root canals in clinical practice may be less harmful to the organism and to the health of the periapical tissue through chemical irritation than undestroyed micro-organisms remaining in inaccessible places in the canal, which usually gain access to the periapical tissue after treatment and filling of the canal.

It is difficult to interpret these results in terms of clinical practice and hasty conclusions should not be drawn from animal experiments of this kind. This experiment reveals only the reaction to the drugs used of living, healthy connective tissue of dogs in the periapical region of the teeth. Human teeth treated in a similar manner might present a different reaction to the same drugs. In clinical medication of pulpless root canals, a smaller quantity of the drug would be used, and it would certainly not be allowed to remain in the canal twenty-one days. For this experiment, it was desired to have the drug actually reach the periapical tissues to produce a reaction in order to observe and compare the results produced in a definite period of time.

PULPLESS TOOTH PROBLEMS IN CHARITABLE INSTITUTIONS*

By ALFRED WALKER, D.D.S., New York City

ROOT canal therapy as employed in dental practice today has been very definitely associated with the focal infection problem. Since focal infection was brought into prominence twenty years ago, there has been, first, a period of condemnation of all efforts to save pulpless teeth, and then the period in which we are now practicing, in which it is believed that many pulpless teeth, if properly cared for, may be saved without prejudice to the health of the patient. The undoubted connection between faulty diagnosis and technic in this branch of practice and the health of the

*Read before the Section on Operative Dentistry, Materia Medica and Therapeutics at the Seventy-Third Annual Session of the American Dental Association, Memphis, Tenn., Oct. 20, 1931.

patient has made it necessary to revise our ideas of technic and also of teaching.

Before the year 1910, it was quite permissible to treat root canals with only a meager attempt at asepsis, and it was therefore considered proper to teach the technic of root canal treatment in the dental school as a part of operative dentistry, and under the same general conditions as were held to be suitable for the filling of cavities and other operations in that field. Today, it is considered imperative that the highest attainable degree of asepsis be maintained throughout all stages of root canal therapy, and in addition there is an insistence on the greatest care in diagnosis and selection of cases.

It is generally admitted that the maintenance of complete asepsis in the surgical sense is not essential to proper operative procedure, such as the preparation and filling of cavities. It is, therefore, unnecessary to organize the operative clinic in the infirmary as the operating room of a hospital is organized. But when we come to that part of dentistry which has to do with root canal technic, the situation is quite different.

Here, the most rigid asepsis is a requisite, and the clinic for the treatment of these cases should be organized accordingly. For this reason, I hold that the first step in the organization of this clinic is to provide means whereby asepsis may be both taught and practiced. Naturally, this implies the housing of the clinic in a room especially equipped and in which only this work is carried on. This makes possible the proper care of equipment, the proper sterilization of instruments and dressings and proper control of conditions prevailing during each operation. The separate housing of the root canal clinic serves another very important purpose; namely, to impress on the operator the importance of this work and the necessity for carrying on in the proper manner.

It is generally agreed by those who have given the most thought to this branch of practice that success in this field demands, among other things, the highest degree of concentration by the operator on the work that he is doing. He should be free from the distractions which are inevitable in a large operative infirmary and he must be taught the importance of keeping his mind continuously on the operation that he is performing; the reason being that it is so extremely easy to break the chain of asepsis through some thoughtless movement and, furthermore, it is also easy to have some accident, such as a perforation, occur, if one's mind is drawn from the operation for even an instant.

The accurate sterilization of the instruments requires very close attention, and therefore should be entrusted only to one who can give the necessary time and attention to detail. In large infirmaries, this would entail a considerable amount of the working time of one nurse.

The clinic should be conveniently located near the general diagnostic clinic and x-ray department. This provides for ease of communication and consultation between the two departments, which is often necessary. In the larger type of dental clinic in public institutions, it would be desirable to have a special x-ray machine in the root canal clinic. This should be of such a type that it may be readily moved about from chair to chair, so that roentgenograms may be taken as needed in the course of operations, without the removal of the rubber dam.

The practice of root canal therapy should be founded on diagnosis. This may conveniently have two divisions. The first step in diagnosis, that relating

to the general examination of the patient, is carried on in the diagnostic clinic. Here, the mouth is examined, a complete roentgen-ray series is made and the general health of the patient is inquired into; this step including, if necessary, examination by a physician. By this means, the general question of the suitability of the case for root canal treatment is determined. When the need of root canal therapy has been determined and the case is considered suitable from the health standpoint, the patient is referred to the root canal clinic, where diagnosis of the condition of the tooth in question is made. At this point, it may be permissible to propose a classification of cases which may conveniently be used in both teaching and practice. The primary thought in developing this diagnostic outline has been simplicity and practicability, two important features from the teaching standpoint.

PULP CANAL THERAPY—CLASSIFICATION OF PATIENTS

Type 1: Under 30 years of age, good health, vital pulps and absence of clinical or roentgen-ray evidence of apical bone involvement.

Type 2: Under 30 years of age, good health, vital or nonvital pulps, clinical or roentgen-ray evidence of slight periapical bone involvement.

Subtype (a): Moderate apical bone involvement.

Type 3: Over 30 years of age, good health, with conditions as in Type 1.

Subtype (a): The same, with conditions as in Type 2.

Type 4: Over 30 years of age, poor health.

Type 3 is to be given careful consideration before treatment is undertaken. Type 3, subtype (a), and Type 4 are unsuitable for conservative treatment.

SUBJECTS OF INQUIRY REGARDING PATIENT'S HEALTH

Family history

Personal history as to recurrent inflammatory or debilitating disease

Present health as to the foregoing (including, if necessary, blood count and hemoglobin determination)

Collateral local conditions

History of tooth

Location of tooth

In no phase of dental treatment is diagnosis of greater importance than in pulp canal therapy. The development of a high technical skill is not only useless, but also even dangerous, unless the operator is impressed with the thought that the suitability of the case for treatment is the most important considerai on. In developing technical skill, the importance of maintaining surgical asepsis should never be lost sight of for an instant.

A considerable proportion of the time which the student spends in the root canal clinic may well be spent in the study of diagnosis. If we can impress on him this fact, and can then so train him that adherence to a surgical technic for maintaining asepsis becomes second nature, the development of technical skill may be depended on to take care of itself.

Another matter which is important in the root canal clinic is the appointments. Each case, when it is started, should be so planned that the patient will come to the clinic at the proper intervals for treatment. This makes it possible to carry through the treatment of cases on a proper appointment basis. It also provides for having the patient return at the correct intervals for treatment; which has a definite influence on the success of the case.

Generally speaking, root canal work should not be included in dispensary service. The reasons for this are: (1) the demands for asepsis are such that they can scarcely be met in a dispensary because of the prohibitive cost for this type of dental service in relation to the

fees which can be collected; (2) the average dispensary operator cannot be expected to have the diagnostic and operative skill which must be employed if this work is to be successful.

Another feature which is to be considered is that of the greatest good to the greatest number. Dispensary service is planned for those of moderate means, whether it is on a pay basis or not, and it is important that the policy of the dispensary be developed with the thought that its service shall reach the greatest number of patients. Such service as is rendered should involve the least possible degree of uncertainty as to the outcome for those who receive it. It must be recognized that, even in the hands of the most skilful, root canal therapy is not 100 per cent successful. The same statement may be applied to other fields of dentistry, such as periodontia and partial denture service. For these reasons, it is not considered good judgment to include root canal therapy in the usual dispensary service. If special dispensaries, on a pay basis, are organized, to offer a higher type of dentistry at higher fees, the root canal service may be included. If this is done, it must, of course, be so planned and maintained as to at least be on a par with the service in the best type of dental school clinic.

100 West 59th Street.

ROOT CANAL THERAPY AS A SPECIALTY OF DENTISTRY

By FRED R. ADAMS, D.D.S., New York City

SHALL we have specialists who do only root canal work? This could be made the shortest paper on record by the simple statement "Yes."

The desirability of specialization in any branch of dentistry must be considered from more than one point of view. The population of a locality is an important consideration from an economic standpoint. A specialist must live, and it stands to reason that a living could not be made in a sparsely populated neighborhood. The class of residents is another point. A root canal specialist would find little to do in a poverty-stricken section, for root canal work, on account of the time and skill required, is beyond the means of the very poor. Provided we have a well-populated locality, the residents of which are prosperous, the one fundamental point is: Would the public be better served by specialization or not? I believe that usually they would be.

Admitting that there is an opening for a specialist, the next question to consider is: Who should specialize and who should not? The function of dental education is to produce an all-round dentist. Theoretically, this is done. A graduate of any dental college today should have a comprehensive knowledge of every branch of dentistry; but knowledge

*Read before the Section on Operative Dentistry, Materia Medica and Therapeutics at the Seventy-Third Annual Session of the American Dental Association, Memphis, Tenn., Oct. 20, 1931.

alone will not result in ability. There are some men who would never become proficient in some branches, although they may be most proficient in some others. A good prosthodontist may be a poor exodontist.

Alfred Walker[1] brings out this point when he says, "It is commonly recognized that individuals will develop a high degree of skill in some particular operative procedure, and, try as they will, they cannot reach the same degree of accomplishment in procedures that demand manipulative ability of a different character."

An inherent skill is not enough. There is an adroitness acquired by constant repetitions of the same or similar operations. Manual dexterity is the result of constant practice. It is for this reason that I believe all specialists should be developed from general practitioners and at least five years of general practice should precede any attempt to specialize. At the end of that time, a man should be able to find himself and to know just which branch he is best qualified to follow. He will have developed skill along certain lines. The foregoing statement that a man should have five years of general practice before attempting specialization applies particularly to a man who limits his practice to root canal work, for there is no branch of dentistry more closely associated with the problems of general practice than this.

The specialist is today, in the larger communities, an essential part of the whole scheme of dentistry. Without him, the public would be poorly served. I am not willing to concede that any of the recognized branches of dentistry is more necessary to the health and welfare of the public than the proper treatment of pulpless teeth. I cannot see that the average practitioner is doing root canal work any better than in the past. There is no short cut to thorough work, no easy way. We are all fairly well agreed that much time is necessary, much skill is required and a thorough knowledge of the associated problems is indispensable. The gravity of the results of improper treatment is well known to us all, and the results may be so serious that we cannot afford to take any chances. The health, and many times the life, of the patient depends on the thoroughness of this work. Some may say, "If this problem is so serious, why not extract all pulpless teeth?"—indeed, some do say that very thing. I quote from Henry W. Gillett, "With full realization of the gravity of the secondary disturbance which may result from the retention of undetected foci about pulpless teeth, I am satisfied that the public welfare will not be served by indiscriminate removal of all pulpless teeth."

This point is also well covered in an editorial in the February, 1928, issue of the *Dental Cosmos:*

> This much we are sure of and have proved beyond question: that the uninfected pulp of a tooth may be removed and replaced with a filling material, with absolute assurance that no untoward results will follow; that many infected teeth may be so treated with safety; that the operative procedures which lead to this happy result are relentlessly exacting; that intelligent diagnostic and prognostic ability must be exercised, and discriminating judgment must be used in the selection of cases to be treated.

The indiscriminate removal of teeth is a serious matter. The comfort of the patient many times depends on the retention of these teeth. No physician has any right to order the removal of a tooth without consultation with a dentist familiar with root canal practice. An ordinary sense of honesty should prevent

1. Walker, Alfred: D. Digest, 31:89-90 (Feb.) 1931.

any dentist from extracting a tooth because he either is too lazy or does not possess the requisite skill to do proper root canal work. Many thousands of teeth are sacrificed needlessly every year because some physician arbitrarily orders them out, or because some dentist, not willing to do the work himself, refuses to refer his patient to someone who can do the work, or there is no specialist to whom he can refer the patient.

I believe that most root canal men have a large number of the wives and children of other dentists referred to them. Though the dentist may refer no other patients, root canal work in the mouth of any member of his immediate family he considers too serious to be attempted by anyone but one specially qualified.

There is one very important reason that we should have root canal specialists which has been overlooked in all previous arguments with which I am familiar. We are all of us human, and being human we are subject to temptation. There comes to every man, when he has a particularly difficult situation to overcome, a temptation to slight the work a bit, to say to himself, "I guess that is good enough—it will be all right I am almost sure." This temptation comes more often in following out root canal technic than in any other field of dentistry, because the dentist hopes and trusts *he* will be consulted if any trouble develops. I believe most men put this temptation aside and do the work in as careful a manner as their ability will permit. The specialist cannot succumb to this temptation, for he knows the work he does will be carefully inspected by the dentist by whom the patient was referred. He *must* do the job right.

There are many excuses given by men for not doing the work. One very common one is, "I cannot get my patients to pay for the time necessary to do it properly." Sometimes this is true, but many times it is not. If the dentist would take the same time to explain the necessity for thoroughness, the time required to do the work properly and the possible results of slipshod work, as he does to sell a denture, he would often find the patient willing to pay a reasonable fee. He will find that the patient will pay a reasonable fee to a specialist when he might object to the same fee or a lower one if charged by the general practitioner. Another excuse often given is, "I do not like the work." This excuse is usually made by those who have not the skill or knowledge to do the work properly. These men have no honest recourse except to send the patient to someone who they believe possesses the ability to do the work properly. More often than almost any other excuse, we hear, "I do not believe in root canal work." I am willing to admit there are some men who honestly have this belief, although I cannot understand how such an opinion can be possible to one who is familiar with modern methods and with the results obtained by using them. Sometimes this statement is a camouflage for the real reason, which is that a larger fee can be collected for less work by extracting the tooth and replacing it with some form of restoration.

It is unfortunate that the problem of the treatment of pulpless teeth is not taken more seriously by many. Edouard M. Hall, in that admirable little book of his, "Pulpless Tooth Problems," says:

> Our new responsibility as a branch of the healing art, having to deal with mouth infections in their relation to systemic disease, seems to rest lightly upon the mind and conscience of altogether too many dentists. Many of these same indifferent operators

have held up their hands in holy horror and loudly protested against the ruthless extraction of teeth; yet in their daily practice they are doing root canal work in such an unscientific and careless manner as to justify the hundred per cent propaganda.

Justice and fair dealing demand that knowing, as we do, that root canal work can, in selected cases, be done successfully, it is our duty to perfect ourselves in the exacting technic required, and to follow out every detail of this technic or to refer our patients to someone who we are satisfied possesses the necessary skill and knowledge, and will apply that skill and knowledge in doing the work properly. I believe that the best interests of the public will be served by having, when the conditions warrant, specialists available to whom this work can be referred.

CORRELATION OF PRECEDING PAPERS, WITH DIAGNOSTIC DEDUCTIONS*

By J. R. BLAYNEY, D.D.S., Chicago, Ill.

MORPHOLOGY OF ROOT CANALS

CERTAINLY, the thorough knowledge of the anatomy of the part to be operated on is of prime importance if the surgeon expects a satisfactory outcome. The more familiar the operator is with the region, the less trauma he will produce, and the more rapid the recovery. This fact pertains to pulp canal therapy just as much as it does to other regions of the body. The possible variations of pulp canals are so great, and such is our inability to recognize their anatomic form *in situ* that it is impossible to predetermine accurately their structure. The clinician will profit materially by a study of Hess' work; for he will thereby come to appreciate the vast variety of forms which may occur.

There are two ways in which each practitioner may increase his knowledge of internal dental anatomy:

1. The roentgenographic examination is a most useful means of studying the anatomy of the root tissues. This examination should be made prior to all operative procedure except the relief of pain. By a careful study of a well prepared film, the operator can gain an idea as to the number of roots which a given tooth possesses, the relative length of these roots and the relative size of the pulp canals and their general direction, as well as the relation of the apex to other nearby structures.

2. Frequently, it is my practice to make a detailed study of the anatomic structure of a tooth after extraction. Especially is this so if it is a tooth on which I have formerly operated within the canal. This study is made by carefully dissecting out the pulp canals; that is, grinding away one surface of the tooth from the pulp chamber to the apical foramen. This method of study will

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*Read before the Section on Operative Dentistry, Materia Medica and Therapeutics at the Seventy-Third Annual Session of the American Dental Association, Memphis, Tenn., Oct. 20, 1931.

do much to teach the busy practitioner the size, general direction and shape of the canals. Concerning this last property, shape, I should like to remind you that, in cross-section, pulp canals are not necessarily round or even smooth in outline; that many irregularities exist; that, in longitudinal section, a pulp canal is not conical, and also that the outline may be quite irregular. I am afraid that these irregularities are not fully appreciated by many operators. The roentgen-ray film is responsible, I suppose, for engendering the thought that the inner surface of the canal is smooth and that it resembles a cone in shape. These dissected specimens should be retained for study from time to time, especially prior to operation on a similar case.

In regard to the relation of the tooth apex to surrounding anatomic structures, much may be said. To illustrate, I will describe a case sent to me for consultation two months ago.

The patient, a young physician, complained of an anesthesia of one-half of the lower lip following the pulp treatment of a lower bicuspid. She stated that a few hours after the pulp was removed, the lip became numb. The next morning, the lip was normal. The anesthesia returned almost immediately after root canal filling and had persisted for five days. Roentgenographic examination revealed the root apex and the mental foramen superimposed, also a sizable amount of filling material beyond the apex. After the case had been observed for several days, during which time the symptoms did not improve, the tooth was extracted. The following morning, eighteen hours later, the lip was normal.

There are other adjacent structures that should be considered in all diagnostic efforts, such as the maxillary sinus, the nasal cavity and the mandibular canal.

The number of apical foramina in a given tooth cannot be determined by any clinical method with which I am acquainted. From a microscopic study of root ends, we well know that any tooth may have several openings to the periapical tissues, also that it is mechanically impossible to cleanse thoroughly and fill all of the accessory canals. By roentgenographic study, we can determine whether the apical foramen is large or small, and sometimes we can make out a lateral opening which lies in the correct plane to be recorded in the film. From the diagnostic approach, it is well to assume that collateral branching exists in all those cases which do not have a wide or funnel shaped foramen. Cases managed with this idea in mind have the best prognosis.

Dr. Skillen spoke of the histologic differentiation between vital and necrotic cementum. I wish it were possible to present so definite a picture from the clinical approach. I am acquainted with only two methods and neither is infallible. The root end roughened by resorption which is associated with the presence of a purulent exudate through a sinus in the soft tissue is very likely to possess areas of necrotic cementum. Also, those cases in which a purulent discharge through the canal continues after three or four well directed treatments have been applied will usually reveal necrotic areas when examined after extraction. Resorption of the root end alone does not indicate necrosis. One fact is certain: a root-end containing areas of necrotic cementum is not satisfactorily treated by pulp-canal therapy alone. Root resection is often indicated.

Dr. Hatton mentioned the destruction of the labial or buccal plate of bone which normally covers the apex. While it is true that this condition exists in many cases, I have anatomic specimens in my laboratory in which the apices of upper cuspids and the buccal roots of first molars were never protected by a

plate of bone. This is a normal condition which may exist. By percussion, the operator may determine clinically whether the labial or buccal plates of bone have been resorbed. The tip of the index finger of the left hand is gently placed on the soft tissue overlying the apex and the tooth is then struck a staccato blow with a metal instrument. This blow is repeated while the position of the index finger is slightly shifted. When the vibrations set up by the blows on the crown are readily perceived by the index finger, we know that at least a portion of the overlying plate of bone has been removed.

Before root resection is recommended, a thorough examination of the tooth root, both clinical and roentgenographic, should be made. Even though the remaining periodontal membrane and alveolar process have accommodated themselves to this increased load, it is a safe premise that unless two-thirds of the membrane and process remain functionally active after the operation, resection is contraindicated.

Concerning pulpal abscesses, I shall speak only of the second or closed form because they are the more interesting from the diagnostic view. Such cases are extremely difficult of diagnosis, especially in multirooted teeth. I am gradually, step by step, coming to believe that many pulps, either under large fillings or where the carious process has approached too close, die as a result of repeated abscess formation.

As Dr. Hatton stated, the roentgenographic study reveals nothing, a fact which is too little appreciated. A tooth which is roentgenographically negative needs additional study before we can determine its state of health. It is much more difficult to state definitely that a tooth which does not contain a root filling is free from pulpal degeneration than it is to evaluate the condition of a root filled tooth.

Cases with small pulpal abscesses present an extremely varied group of symptoms, while others are symptomless. Frequently, there is a vague diffuse pain which does not tend to localize. Again discomfort follows exercise, suddenly leaning over or on lying down, etc., described sometimes by the patients as a full feeling. The tooth may be sensitive to thermal changes during the height of the process, but when this has passed, it is again comfortable. It is only through the most painstaking efforts that the offending tooth may be located, and it frequently requires considerable courage to suggest the removal of a pulp from a tooth which presents no outward signs of trouble. It is not sufficient to determine the vitality of the pulp: we must strive to determine the normalcy of each pulp. In concluding his discussion, Dr. Hatton states that "pulpal abscesses occurring under large fillings are relatively rare." I should like to add "but are more common than many clinicians realize."

As regards the diagnosis of radiolucent areas about root apices, I wish to call attention to a very interesting case I had this summer.

The patient, a woman, aged 50, complained of arthritis. The physician suggested mouth examination. Roentgenographic study disclosed a small radiolucent area about the apex of a lower central incisor. Clinical examination of the tooth was negative. The physician insisted on the removal of the tooth. The patient also thought the tooth was the cause of the arthritis. As the last resort, the dentist carefully removed the tooth, placed it in solution of formaldehyd and sent the tooth to me for histologic study. The findings were interesting. The pulp was normal throughout. The root end did not show evidence of past or present resorption but, quite the contrary, a hyperplasia of apical

cementum. The small mass of soft tissue attached to the apical cementum at a considerable distance from the foramen was found to be very cellular but entirely free from all inflammatory cells. These cells were like young fibroblasts with very little intercellular substance. There were many areas of hyalination, some of which were undergoing calcification. The entire picture in every respect resembled that of a fibroma and not that of an inflammatory reaction.

Whenever the clinical findings disagree with those of the laboratory, those of the clinic should be accepted.

Dr. Coolidge has contributed a most interesting discussion on the use of drugs. His warning that it is difficult to interpret all of these reactions, especially in regard to direct application to the human being, is valuable. His findings may act as a guide or checkmate for our clinical procedures.

We have advocated for a long time that only the smallest possible amount of a drug should be used, that drugs should never be allowed to escape into the periapical tissue and that chemic necrosis is very detrimental. What we have seen demonstrated this afternoon should explain fully why a tooth becomes sore after treatment with certain drugs, why the pulp-canal is filled with a fluid —a transudate—following the application of some medicaments, why those remedies which coagulate protein produce a rapid chemical necrosis of tissue remaining within the pulp canal or in the periapical tissue and also why too often repeated or long continued medication is dangerous.

Dr. Walker has emphasized the importance of a thorough diagnosis, the necessity of a proper interval between each two appointments and the requirements of an exacting technic, both mechanical and aseptic.

As regards the advisability of developing pulp canal therapy as a specialty analogous to orthodontia, etc., I have my doubts. The number of patients who need this type of service is so great that it would be impossible for them to consult a specialist. I believe that a large amount of this work can be satisfactorily managed in the office of the general practitioner. In metropolitan areas, a few specialists are of value.

(A review of the paper presented by Dr. Rickert is omitted because a copy was not available for study.)

PRACTICABILITY OF THE NEW ANGLE EDGEWISE RIBBON ARCH*

By RALPH WALDRON, D.D.S., Newark, N. J.

ORTHODONTIA, according to James D. McCoy, is a study of dental and oral development, seeking to determine the controlling factors in growth processes, to the end that a normal functional and anatomic relationship of these parts may be realized, and aiming to determine the influences necessary to maintain such conditions when once established.

According to Pullen, it is that science which treats of the etiology, diagnosis and treatment of the abnormal, in the development of the dental and maxillary arches, and of their relation to a symmetrical contour of the face.

Normal occlusion is usually considered as that condition of perfect relationship existing between normally formed and arranged teeth of normally developed dental arches when in antagonism, the mandible being in its farthest posterior position, and in exact median register with the maxillae, and both in normal relationship with contiguous tissue.

A. LeRoy Johnson defines the individual normal as the most nearly perfect condition of occlusion that the nature of the tissues and the functional activity of the organism as a whole will permit.

If we will consider these definitions for a moment, we shall at once see that etiology, diagnosis and treatment must be considered before a prognosis can be made.

It is true that we cannot always know the etiology of a given case of malocclusion, and it is not always necessary to know the etiology of a certain case of malocclusion before a desirable result can be obtained, but the etiologic factors should be considered as far as it is possible to ascertain them, for a definite prognosis cannot be assured if the etiology is unknown.

It is necessary that a correct diagnosis be made before treatment is instituted or the end result will be failure. After a diagnosis is made, and a line of treatment contemplated, we should select an appliance that will bring about the desired results with as little functional interference as possible.

Some cases require treatment in one dimension, and the most simple appliance that will bring about the desired results is undoubtedly best for such a case. But, in extremely difficult cases, especially those in which facial deformity is involved, an appliance is necessary which possesses capability of control in three dimensions, and for such an appliance my choice is the new Angle edgewise mechanism.

The following is a case report from my practice compiled by my associate, Richard Lowy.

The classification and differential diagnosis of dentofacial deformities have long been a topic for debate. Since the intro-

*Read before the Section on Orthodontia at the Seventy-Third Annual Session of the American Dental Association, Memphis, Tenn., Oct. 20, 1931.

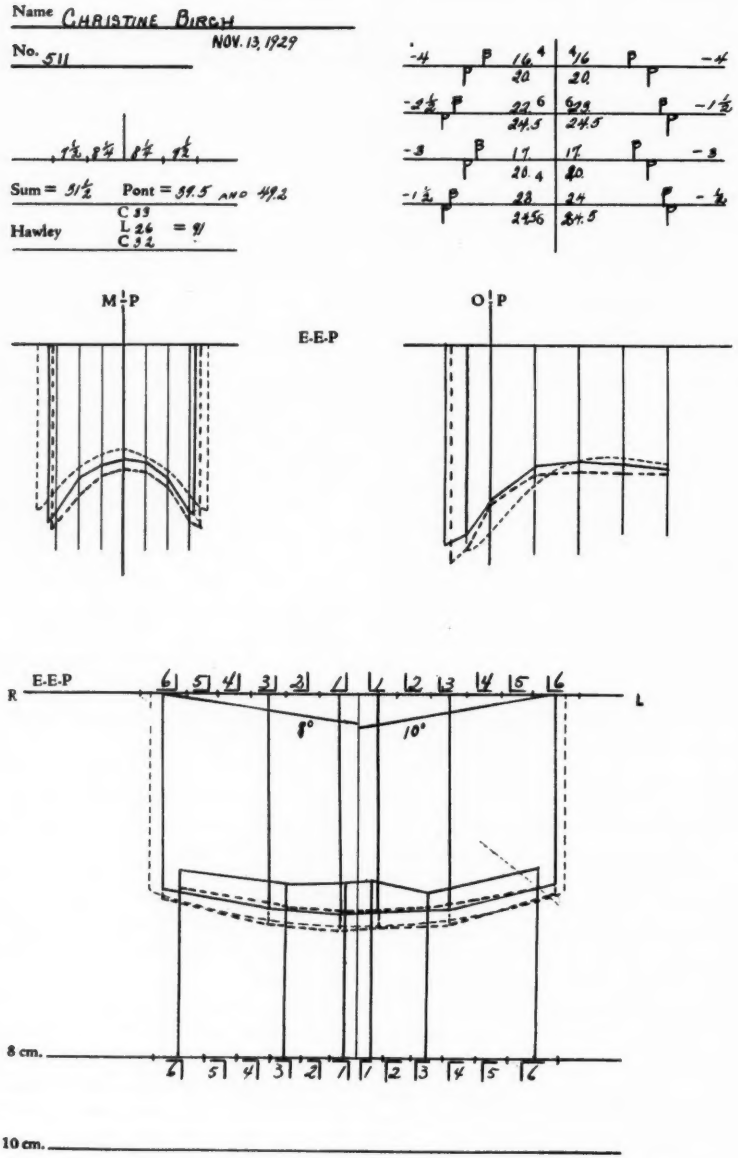

Fig. 1.—Gnathostatic graphs in three dimensions of case before and after treatment.

duction of gnathostatic diagnosis into this country, in 1924, by Paul Simon, of Berlin, this office has made it a routine procedure; hence, this case report is presented in this manner.

has really happened in this case through treatment with the Angle edgewise mechanism and tie bracket bands.

Figure 1 shows a graph of this case in three dimensions, namely a cross-section

Date ..... 19 .....

DIFFERENTIAL DIAGNOSIS

Name C. B. Age Sex F Case No. 511 Chart No.

A—The relations of the lateral halves of the denture to the median plane.			Degree	
Upper	Contraction / Distraction	Horizontal localization: lateral—incisal—Total	Mild / Medium / Extreme	Symmetrical / Asymmetrical
		Vertical localization: dental—alveolar—maxillary		
Lower	Contraction / Distraction	Horizontal localization: lateral—incisal—Total	Degree: Mild / Medium / Extreme	Symmetrical / Asymmetrical
		Vertical localization: dental—alveolar—mandibular		
B—Relations of the denture to the orbital plane.			Degree	
Upper	Protraction / Retraction	Horizontal localization: lateral—incisal—Total	Mild / Medium / Extreme	Symmetrical / Asymmetrical
		Vertical localization: dental—alveolar—maxillary		
Lower	Protraction / Retraction	Horizontal localization: lateral—incisal—Total	Degree: Mild / Medium / Extreme	Symmetrical / Asymmetrical
		Vertical localization: dental—alveolar—mandibular		
C—Relations of the denture to the horizontal plane.			Degree	
Upper	Attraction / Abstraction	Horizontal localization: lateral—incisal—Total	Mild / Medium / Extreme	Symmetrical / Asymmetrical
		Vertical localization: alveolar—maxillary		
Lower	Attraction / Abstraction	Horizontal localization: lateral—incisal—Total	Degree: Mild / Medium / Extreme	Symmetrical / Asymmetrical
		Vertical localization: alveolar—mandibular		

Fig. 2.—Differential diagnosis.

The presentation of this case, with its gnathostatic and photostatic data, is not offered with the thought of continuing or prolonging a debate, but to show what

of the width, in the first maxillary molar region 2 cm. distally from the orbital plane, a cross-section of the maxillary model in the raphé median plane, and a

TREATMENT

Upper—

1. Band 6 6 — Oval Buccal tube / Lingual tube / Buccal tube — 2nd molar spring
2. Use Lingual appliance — Plain lock / Tilting lock — Auxilliary springs
3. Band 7 7
4. Widen 6
5. Widen 4
6. Contract 6
7. Contract 4
8. Band 5 4 3 2 1 1 2 3 4 5 Tie Brackets — 1. Change position of Brackets. 2. Later use Picket Fence.
9. Step up to 22 x 28 — Use spur Mesially to Molar Tube.
10. Look to rotations
11. Anterior segment — Protract / Retract — Intermaxillary elastics / Intramaxillary elastics / Occipital anchorage—Maxillary Bar / Chin Cap
12. Incisors — Depressed / Elevated
13. Align to Hawley Chart 92
14. Retain — Hawley / Lingual

Lower—

1. Band 6 6 — Oval Buccal tube / Lingual tube / Buccal tube — 2nd molar spring
2. Use Lingual appliance — Plain lock / Tilting lock — Auxilliary springs
3. Band 7 7
4. Widen 6
5. Widen 4
6. Contract 6
7. Contract 4
8. Band 5 4 3 2 1 1 2 3 4 5 Tie Brackets
9. Step up to 22 x 28
10. Change curve of Spee.
11. Elevate — Incisors / Premolars
12. Depress — Incisors / Premolars
13. Use stops — Loop / Spur
14. Anterior segment — Protract / Retract
15. Look to rotations
16. Align to Hawley Chart 78
17. Retain — Hawley / Lingual

Fig. 3.—Outline of treatment.

graph showing the projection of the occlusal curve which exhibits a measurable estimate from the ear-eye plane, known as the Frankfort horizontal.

DIFFERENTIAL DIAGNOSIS

Figure 2 shows the differential diagnosis of this case. Under *A,* the relations of the lateral halves of the denture to the median plane are shown. In the upper, there is a total dento-alveolar maxillary contraction, medium in degree and symmetric. In the lower, there is a total dento-alveolar mandibular contraction, medium in degree and also symmetric.

Under *B,* the relations of the denture to the orbital plane are shown. In the upper, there is a total dento-alveolar maxillary protraction, median in degree and symmetric. In the lower, there is a total dento-alveolar retraction. The mandible seems to be in good facial balance, and the retraction of the teeth and alveolar process is of mild degree and is symmetric.

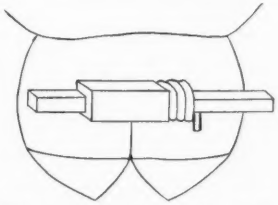

Fig. 4.—Position of molar tube.

Under *C,* the relations of the denture to the horizontal plane are shown. In the upper, there is a total alveolar maxillary attraction of a mild degree which is symmetric. In the lower, there is a total alveolar mandibular attraction of extreme degree, which is symmetric.

PROGNOSIS

Many men would diagnose this case as a Class II, Division I (Angle); in other words, a distoclusion, with protrusion of the anterior maxillary teeth, and some as Class I (Angle), with a total maxillary protrusion. In my opinion none of these terms describe fully the conditions exhibited in this case.

The differential diagnosis just presented revealed fully the conditions exhibited by the gnathostatic model, the photostatic picture and the graph of the model, in the three dimensions, and they convinced us that a three dimensional movement of the teeth was necessary to establish a normal occlusion, plus proper balance of the face. Being cognizant of these conditions, as enumerated in the differential diagnosis, and having decided on a plan of treatment which we felt would bring about the desired results, even though the etiology was obscure, we considered the prognosis very favorable.

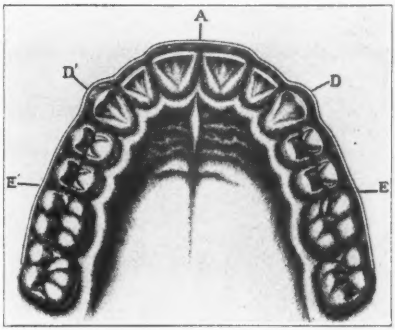

Fig. 5.—Landmarks for determination of both dental and metal arches. (After Angle.)

TREATMENT

The treatment will first be presented in outline form, in order to fix in mind the technic used in this case, after which we will discuss it in detail.

Figure 3 shows the treatment sheet. Before proceeding with the treatment in

detail, let me remind you that the philosophy of the edgewise mechanism is radically different from that of any other appliance, in that it does not depend on any one particular tooth for its anchorage system.

In the past, when tooth movement was discussed, individual tooth movement was meant, but with the advent of the new Angle mechanism, this philosophy was entirely changed, for the new mechanism from first to last is acting on the entire denture, and tooth movement is occurring *en masse,* and all movements are taking place simultaneously.

Formerly, in treating Class II, Division I (Angle) cases, when the maxillary molars had drifted forward, we tipped the molars distally, then brought the bicuspids back in contact with the molars. Then, we moved the incisors lingually, which required at least three separate operations. But with the new mechanism, our conceptions of anchorage are radically different. Every tooth becomes an integral part of the anchorage system, and all tooth movements are occurring at one and the same time.

Seamless molar bands properly swaged and contoured were fitted to the maxillary first molars. The position of the 4 mm. rectangular buccal tube or sheath is of vast importance. It should be so soldered to the band that it will be parallel to the occlusal surface of the tooth, and not produce a torsional twist when the edgewise ribbon arch has been seated within it. (Fig. 4.)

We will now proceed with the making of the alinement wires, and here I do not follow the procedure advocated by Angle and many others. For example, to quote from Angle (page 14, in "The Latest and Best in Orthodontic Mechanism"):

> Now how is the proper shape of the metal arch to be determined? There are in dentures five points or "landmarks," so to speak, from which the ideal—the typal—form of both dental and metal arches may be quite accurately determined, regardless of the irregularity of position in which the teeth may be found. This at least is possible to him who can interpret the mechanics of the dentures, and relate the types of the teeth to the type of the individual. These landmarks are indicated at *A, D, D', E,* and *E'* [Fig. 5], which is a drawing representing the ideal arrangement of the teeth in a fairly average normal upper dental arch, with a metal arch lying in juxtaposition to the teeth at the points of their proximal contacts.
>
> It will be noted that there is a straight line from the center of the labial ridges of the cuspids, *D, D',* to the center of the mesiolabial ridges of the first molars, *E, E'.* This line is *always* straight, regardless of the degree or form of the curve of the anterior part of the dental arch, or of the lateral width between either cuspids, or the molars of the halves of the arch; this width, of course, always varying according to the type of the individual,

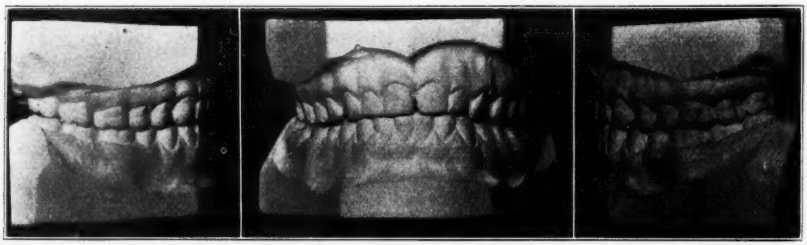

Fig. 6.—Untreated case. (After Kelsey.)

that is, as widths of the incisors intervening between the cuspids and the typal curve of the individual arch vary.

This part of Dr. Angle's paper I do not agree with, and I have proved with the aid of several models taken from the collection of J. Lowe Young, Harry E. Kelsey and Milo Hellman, that the bicuspids do not lie upon a straight line running from the labial ridge of the cuspid to the mesiolabial ridge of the first maxillary molar, and I agree with Hellman that the best dentitions do not correspond to the conceived abstract ideal,

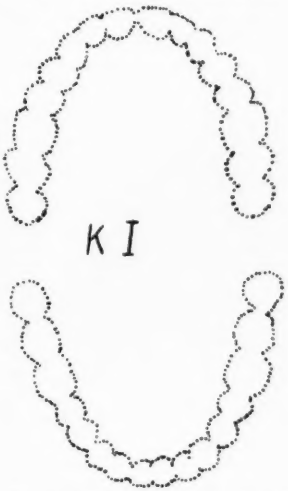

Fig. 7.—Occlusal graph of case shown in Figure 6.

as is illustrated in Figures 6-7, which are but a fair example of those cases that we investigated.

Also, I am of the opinion that Angle has overemphasized the lingual position of the lateral incisor. It is a fact that the lateral incisor is thinner labiolingually and that it is much shorter than the central incisor which makes it less prominent than the central incisor or the cuspid, but I do not think that it should take such a retiring position as one would imagine after reading Angle's paper.

This is only a difference of opinion, and possibly of no great importance, for these teeth will ultimately assume their best functional relationship in spite of what we may all think.

You will observe that my criticism of Angle's arch form is not severe, for I agree with him in the main, except as to the extremely retiring position of the lateral incisors and the final arrangement of the maxillary bicuspids and first molar being on a straight line.

In shaping the metal arch, we measure

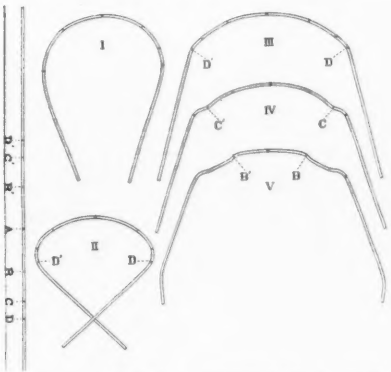

Fig. 8.—Technic of construction of metal arch.

the width of the incisors and the cuspid teeth, and, to this, we add 0.010 inch, which represents the thickness of the band when cemented in position. We then mark off on the piece of 0.022 by 0.028 elastic gold material the width of the central incisor, the lateral incisor and the cuspid, plus 0.010 inch for each tooth. Next, we mark the position of the labial ridge of the cuspid, and proceed to bend the arch as described by Angle (Fig. 8), using a Hawley arch chart as a guide for a more symmetrically formed arch wire as shown in Figure 9.

Figure 9, left, shows a drawing selected by Dr. Angle as representing the ideal arrangement of teeth in a fairly average normal upper denture, upon which is superimposed a Hawley chart of 0.96 size. You will see how closely it approximates the ideal arch form of Angle.

Figure 9, right, the same drawing with a Hawley chart of 1.04 size superimposed on it, shows how closely the metal arch will conform to Angle's ideally formed arch wire, being about four sizes larger than the Hawley arch predetermination for this case.

With this symmetrically formed arch wire as a base as shown in Figure 9, right, we proceed to widen, narrow and modify it in shape to conform to our own preconceived idea of what the arch form for this particular case should be.

For narrow dentures, we are guided somewhat by Hawley arch form, and for wider cases by the Pont index, not necessarily adhering very closely to either, but using judgment, always considering the typal patterns of the teeth, the type of the face and skull and the general type of the individual; which I think is the method most in use as a guide in determining arch form for any given case.

With all the foregoing facts in mind, we proceed to make the arches necessary for the case.

Realizing that a 22 by 28 edgewise arch cannot be used at the beginning of treatment, we deemed it advisable to use round arch wires of smaller size, made from gold platinum alloy and of the same composition as the 0.022 by 0.028 edgewise arch, but of 0.018, 0.020, and 0.022 size.

Previously, we stated that the thickness of the bands must be taken into consideration, and though the diagnosis indicated that the corrected case should in size correspond to a Hawley upper 0.92 chart, the labial arch wires must necessarily be larger than the Hawley arch predetermination chart. Hence, the arch wires were made to correspond to a Hawley 98 chart.

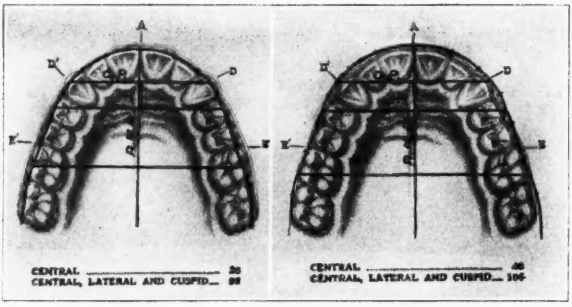

Fig. 9.—Drawing of ideal maxillary arch (after Angle); showing Hawley predetermination charts 0.096 and 1.04 superimposed on drawing.

In order to prevent crimping or buckling of the arches during their construction, a modified arch former is used, in the form of a mandrel, having a groove or slot for the reception of the 0.022 by 0.028 wire, which fits accurately within the groove. With this instrument, we can produce a perfect edgewise bend.

This instrument is shown in Figure 10.

When the alinement wires have been made to the exact form and size, and the stops soldered in their respective positions, the arches, both round and rectangular, should be so tempered that they will possess the utmost of spring force, and yet not be brittle.

For this purpose, I have devised the appliance shown in Figure 11, consisting of a heavy copper box with hinged cover, and a central tube riveted to the bottom of the box or pot, in which a laboratory thermometer is placed and is packed in position with fine copper fillings.

The accuracy of this thermometer has been tested by placing a piece of pure zinc in the tempering box and observing its melting point and the height of the mercury column of the thermometer. Zinc melts at 786 F., and the mercury column should register very close to this mark.

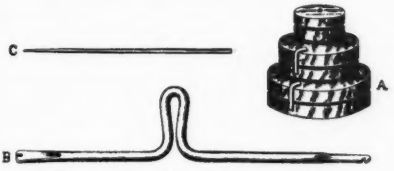

Fig. 10.—Arch bending mandrel.

The reason for using this type of tempering device is, first, its accuracy, and, secondly, we have no liquid base metal in the tempering box, giving off fumes which may contaminate our appliances, which I believe can be seriously affected by such fumes.

I find that the arch material I use tempers at 786 F. with the best results.

The next chronologic step in the treatment is the proper positioning and formation of the bands on the individual teeth. These bands must be so located that when tooth alinement is completed, each bracket will be seated on the arch wire, and this will be practically unmodified in the horizontal plane, except as is necessary to produce such depressions, elevations or axial modifications as are demanded by treatment.

Fortunately, we have an accurate gage to follow in locating these bands. (Fig. 12.) On the incisors and cuspids, they should be placed in the middle third of the crown of the tooth, and the operator can judge this closely because, in such a location, there will be just as much enamel exposed gingivally to the band as there is occlusally to it. It is well to mark this area with a lead pencil before forming the band, as thus accuracy will be assured.

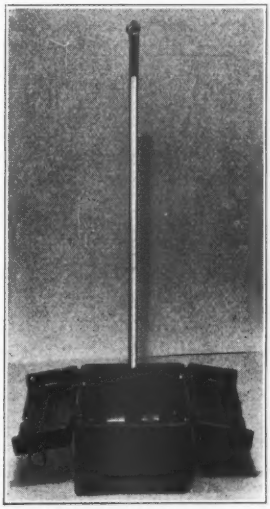
Fig. 11.—Tempering box, with laboratory thermometer attached.

On the bicuspids and deciduous molars, adjustment is such that there will be about one sixty-fourth inch of the occlusal edge of the band overlapping the mesial and distal marginal ridges of these teeth, in order to assure stability of the

bands against the occlusal force, but it should not be long enough to interfere with the occlusion, as the constant contact of the maxillary and mandibular teeth is liable to break the cement and thereby loosen the band. When the standard band as furnished by the manufacturer is of insufficient width to permit this overlapping, I use a seamless bicuspid band and solder the bracket to this band at the desired position. The location of the bracket or slot is important. From the point of view of esthetics, it is

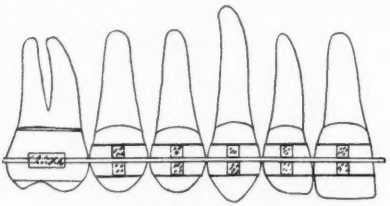

Fig. 12.—Correct alinement of bands.

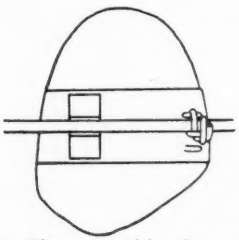

Fig. 13.—Placement of bracket and midget rings for rotation.

better that they be in the center of the labial surface, but the practical or the efficiency position takes precedence; e. g., if a tooth is to be rotated, the bracket must be placed nearest the more prominent angle, and a staple soldered to the bands at the opposite angle as illustrated in Figure 13. If there are no rotations to be made, or all have been accomplished, the operator should endeavor to place all brackets in the center of the teeth, in the direction of the long axis of the teeth.

In Figure 14, you will observe that the tie brackets are all practically in a plane, which reduces the amount of variation in the horizontal to a minimum, and, by the manipulation of the horizontal edgewise arch wire within the bracket bands, teeth can be readily elevated or depressed, or axial relations changed, and thus the further use of

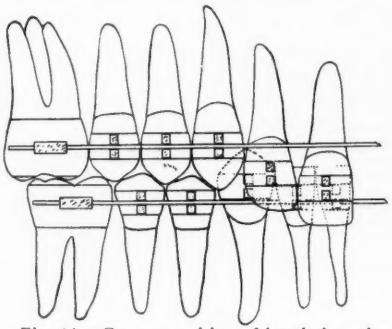

Fig. 14.—Correct position of bands in order to place all teeth on desired plane.

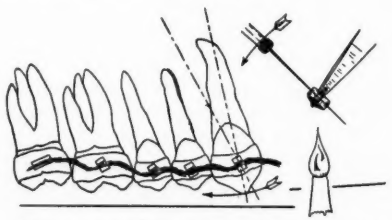

Fig. 15.—Resoldering of brackets to bands, to change vertical relation of long axis of tooth.

bite planes becomes unnecessary in the correction of the overbite in certain cases of malocclusion. (Fig. 14.)

In the case under consideration, we found a dento-alveolar maxillary protraction. The maxillary molars and bicuspids had drifted forward and were not in correct axial relation, and the case

also presented a deep overbite.

For this order of tooth movement, Angle offers two methods and both were utilized in this particular case. Although at the present time we consider only one as being necessary to accomplish this purpose, the latter will be described later, or what is known as the "picket fence" principle.

In order to accomplish the distal tipping of the crowns of the teeth, the bands were first fitted to the teeth. Then, the angle of attachment of the brackets to the bands was altered, and thereby the brackets of the band are changed in its vertical relation to the long axis of the tooth, as shown in Figure 15. This caused the labial arch wire to bind in the mesio-incisal and the distogingival corners of the brackets, thus tipping, and changing the angle of inclination of, the teeth.

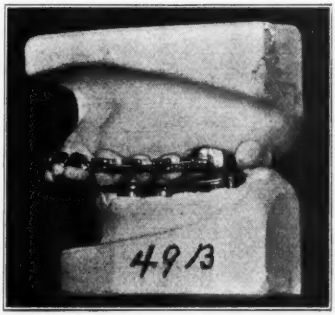

Fig. 16.—Case under discussion with 0.020 round arch wire in position.

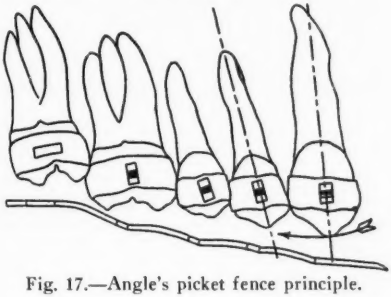

Fig. 17.—Angle's picket fence principle.

Office routine requires the removal of all bands every five months, and the teeth should be thoroughly cleaned and examined for cavities. If caries is found, the patient is then sent to his dentist for further inspection and whatever dental service is necessary. This procedure was followed faithfully. After the visit to the family dentist, the bands were replaced with the brackets soldered to the bands, in the center of the labial surface, parallel to the long axis of the individual tooth.

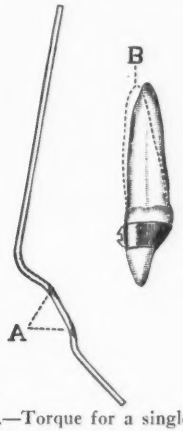

Fig. 18.—Torque for a single tooth.

Fig. 19.—Section of modified lingual arch wire with rotating lock which does not inhibit mesiodistal tipping of bicuspids and molars.

Then a light tempered round 0.018 arch wire was seated in the brackets. (Fig. 16.) The force applied by this small arch wire materially assisted in uprighting the teeth. Later, a 0.020,

then a 0.022 round arch wire was substituted for the lighter gage wire, in order that the malposed teeth might be alined with a minimum amount of inflammation, and a maximum efficiency of control of force through this gradual evolution from the lightest arch wire to the final seating of the 0.022 by 0.028 edgewise arch wire.

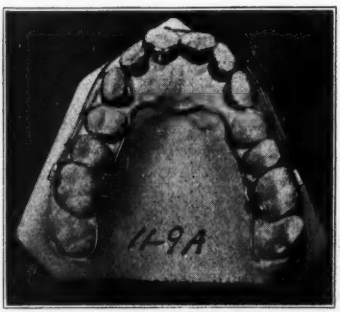

Fig. 20.—Lingual arch wire in position.

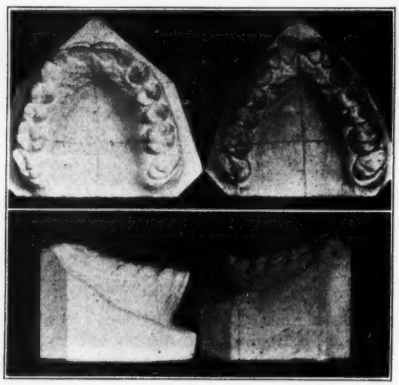

Fig. 21.—Cases before and after treatment.

Not being quite satisfied with the axial relations of the teeth at this point, the "picket fence" principle was employed. This movement is accomplished in the following manner (Fig. 17): 1. We secure a bracket engagement of all teeth. 2. Next, we scratch a mark on the buccal edge of the arch wire, mesially and distally to the edges of the brackets of those teeth that are to be tipped or whose axial relations are to be changed. Then, we mark on the arch wire the location of the anterior end of the rectangular tube of the molar band. 3. With the arch bending pliers, we make compensating vertical bends in the arch wire, anteriorly and posteriorly to the brackets. In this position, the arch lies within the slot of the bracket and is slightly oblique to the long axis of the metal arch.

Thus, the force of the tempered arch wire should exert equal pressure gingivally in the distal end of the gingival wall

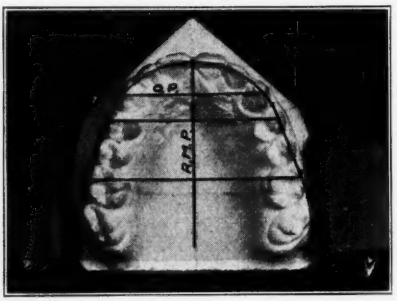

Fig. 22.—Upper casts with Hawley 0.092 chart superimposed upon the same.

of the bracket and occlusally on the mesial end of the occlusal wall of the same. In conjunction with this force, intermaxillary elastics were used only for a period of eight weeks.

It is also of utmost importance that a stop or spur be soldered to the metal arch at a point just in front of the mesial end of the buccal tube, as soon as approximal contact of all the teeth has been established, in order to ensure proper tooth movement.

The third order of tooth movement as advocated by Dr. Angle is that of

"torque." It is that force or power that is derived by slightly twisting the metal arch, in some parts or part, thus storing energy in the arch, which when liberated tends to untwist or torque on itself in the direction of its long axis.

Since the diagnosis called for an increased width in the maxillary arch, strict adherents of Dr. Angle's system of treatment would undoubtedly call attention to the following quotation from Dr. Angle's article, "The Latest and Best in Orthodontic Mechanism."

> Torque also has another very important and practical application, namely that of reinforcing the usual power derived from the lateral spring of the metal arch, for widening or narrowing the dental arches . . . by tipping or rolling the molars or premolars out of their vertical positions by a perpendicular rotating force.

Thus, one can see that torque as applied here is nothing but a tipping of teeth from their vertical position in a buccal or lingual direction requiring two steps: first, the torque, and, secondly, the detorque.

The use of torque for individual tooth movement we believe is an admirable technic (Fig. 18), but we see no reason for its use as an aid for arch expansion as advocated by Dr. Angle. In our opinion, increased width can be accomplished far better with the use of a modified lingual arch. Therefore, that principle was used in the case under treatment. The construction of the modified lingual arch is as follows:

A piece of platinum gold wire, 0.050, was soldered at right angles to the lingual surface of the molar band, on which fits a small tube whose external diameter

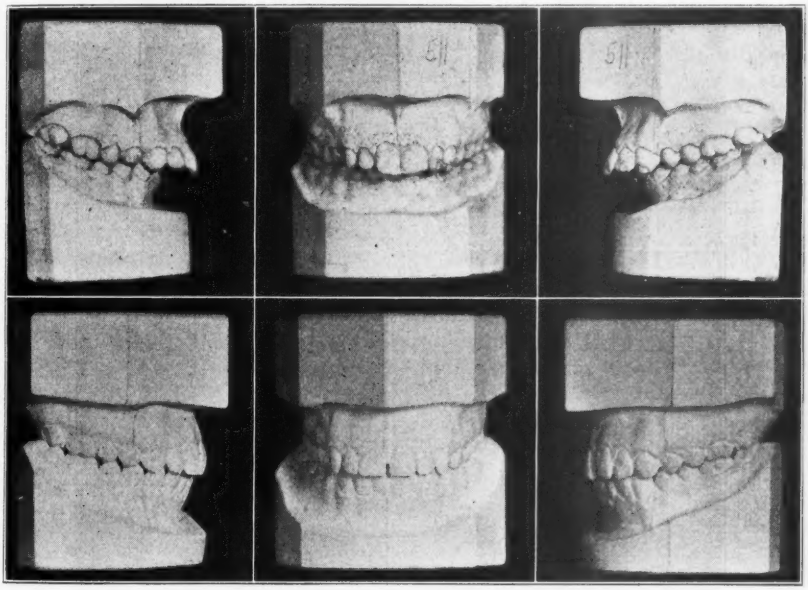

Fig. 23.—Gnathostatic models of case before and after treatment.

measures 0.090 and 0.065 long. This ring fits snugly over the round post. The tube is soldered to an 0.036 lingual arch. The locking of this appliance is accomplished by the ligating with a piece of Wipla wire from the lingual arch wire to a small ring on the buccal surface of the molar band, and augmented by a spur soldered to the lingual surface of the right and left first bicuspid bands, which help to hold the lingual arch up to its work. (Figs. 19-20.)

With this type of lingual arch, the second order of tooth movement is not inhibited, and the axial angle changes, and buccal bodily movement can be accomplished simultaneously.

It must be realized that the mandibular teeth are also undergoing treatment simultaneously with the maxillary teeth.

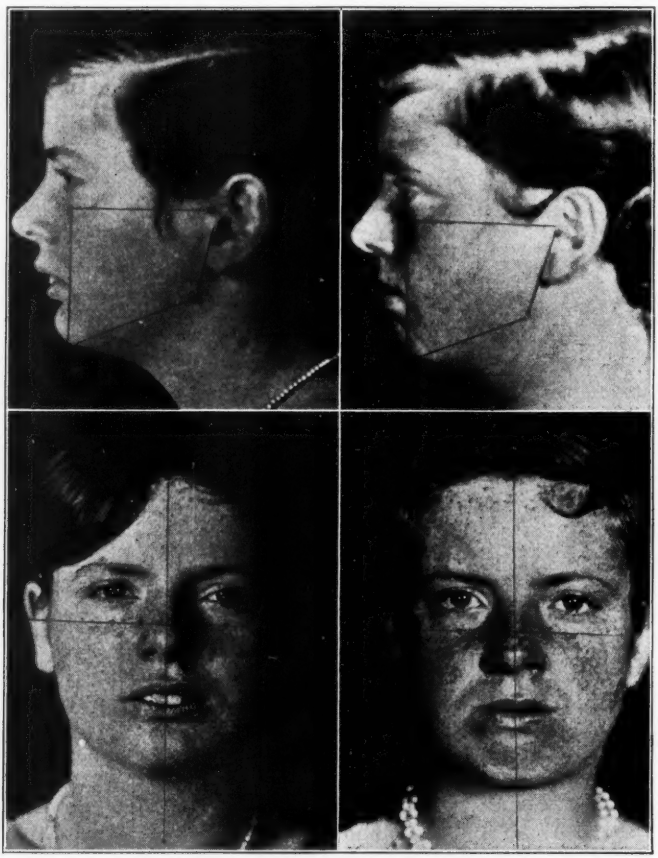

Fig. 24.—One-half life-size photostatic photographs of patient before and immediately after removal of appliances.

They have not been mentioned so far in order to avoid confusion.

The mandibular first molars were banded and the buccal tubes alined correctly, and as the mandibular bicuspids and cuspids required no distal tipping, a regular Mershon lingual arch wire was employed to aid in securing arch expansion.

Diagnosis showed a total alveolar mandibular attraction of extreme degree, and thus the first order of tooth movement was indicated. On inspection of the mandibular gnathostatic model and graph, the curve of Spee was observed to be greatly exaggerated, which in other terms means that the incisors were in supraversion, while the molars and bicuspids were in infraversion.

Thus, by the correct positioning of the tie bracket bands and the molar buccal tubes, and with the proper seating of the labial arch wire, the necessary elevations and depressions of the mandibular teeth occurred simultaneously. Arch expansion was carried on by the action of the lingual arch wire.

Attention must also be given to the total dento-alveolar retraction. The photostatic picture showed the mentum to be in almost its correct position.

Therefore, we find it only necessary to protract the anterior segment of the mandibular dental arch. This was accomplished by the use of stops or spurs soldered to the labial arch wire, just anteriorly to the mesial end of the buccal tubes. In order to increase the forward pressure, minute washers of 0.025 thickness were slipped on the arch wire, between the spur and the mesial end of the buccal tube. (Fig. 4.) In this manner, the alinement wire was extended, carrying the anterior teeth forward.

I shall now present the case with active treatment completed, although it is still under passive retention. The end result confirms our diagnosis; every step in the treatment sheet has been carefully followed, and the end-results have justified the means. Figure 21, above, shows the comparison between the upper models; below, comparison of the lower models. Figure 22 shows Hawley chart 92 superimposed on the maxillary model. Figure 23 shows the case before and after treatment; Figure 24, the photostatic pictures before and after treatment.

RELATION OF FOCAL INFECTIONS OF THE TEETH TO OPHTHALMOLOGIC CONDITIONS*

By E. C. ELLETT, M.D., Memphis, Tenn.

THERE is nothing new in the picture that we now call "focal infection," especially as regards the connection between diseases of the teeth and diseases of other organs, including the eye. Quite definite cases were reported a hundred years ago, and in the last twenty-five years a voluminous literature has grown up about this subject. There is no doubt that disease of the teeth can be the cause of disease of the eyes; nor can there be any doubt that there are many other causes of disease of the eye; and that a person with a sore eye happens to have an abscessed tooth does not necessarily mean that there is any connection between the two conditions.

The structure and development of the teeth are matters that need not be dwelt on here. An important thing to remember is the chemical composition of the tooth and what happens to it as we grow older. Up to the age of 30, the tooth contains much organic matter and less calcareous and mineral elements. As the latter are most resistant to caries, this condition is more common before 30, when the organic matter predominates in the tooth; and when it appears at a later age, it is said to be due to an increased vulnerability of the tooth from the action of an acid saliva, or to the presence of organisms that have entered through fissures in the enamel or otherwise, and slowly multiplied and attacked the tooth. Caries once having passed through the enamel and entered the dentin, a cavity is caused which may attain a goodly size but have a very small external opening. This caries may penetrate to the pulp and thence through the root, causing an apical granuloma or abscess. These abscesses usually contain streptococci or, less often, other pus-producing organisms, and very few leukocytes. In other words, the defense mechanism is feeble. There is no specific organism for dental caries, nor is there anything specific about the appearance or behavior of a lesion in a remote organ due to dental sepsis.

There is another group of apical abscesses not associated with obvious dental caries or infection around the tooth. In these cases, the infection is from the pulp chamber of a tooth in which the pulp has died. In other words, the abscess can occur only in a pulpless tooth. Infectious material passes from the pulp into the tissues around the apex and thus an abscess is caused. The death of the pulp may arise from traumatism or other causes; and in the tissues whose resistance is thus lowered, organisms from the blood stream find a suitable place for development. Under these circumstances, the order may be reversed, and instead of the abscess' being the cause of the systemic infection or remote disease, it may be rather the result of such a condi-

*Read before the Section on Oral Surgery, Exodontia and Anesthesia at the Seventy-Third Annual Session of the American Dental Association, Memphis, Tenn., Oct. 22, 1931.

tion. This is another reason for hesitating to conclude that the presence of an abscess is the certain explanation of an infection in the eye or elsewhere. The infection so often seen around an unerupted tooth is probably to be explained in the same way, with the added fact that any nonfunctioning organ is prone to degenerate.

This is the briefest possible synopsis of my conception of dental sepsis as it concerns apical abscesses, indicating the basis upon which rest my ideas of the teeth as possible sources of systemic infection. While many regions of the body and many organs may suffer from infection derived from a septic focus elsewhere, it is to the tooth as the offender and the eye as the sufferer that these remarks apply.

The most common site of focal sepsis is the mouth. In children, it is found in the tonsils, adenoids and sinuses; in the adults, in the teeth, and less often in the tonsils and sinuses. It is well to bear in mind that these are by no means the only organs to be considered. The intestinal canal, gallbladder, appendix, pelvic organs in woman and prostate and seminal vesicles in men should never be overlooked in the search. That an infected tooth is found is no reason to stop the search, since it does not follow that this is the sole cause and that no other focus exists.

In making an examination of the teeth to find the cause of an infection in the eye or elsewhere, pyorrhea, apical abscesses, septic stumps, infected root fragments left after extraction, unerupted teeth, which are usually infected, and bone infection should be looked for. The way in which these conditions may produce trouble elsewhere varies.

1. In the case of open sepsis, of which pyorrhea is a good example, the infection may occur by direct extension, as in lacrimal disease, inflammation of the conjunctiva and lid margins, corneal ulcer and orbital cellulitis.

2. In the case of closed sepsis, such as in an apical abscess, it may act by lymphatic absorption or through the blood stream, and cause deeper seated trouble in the eye, such as iritis and cyclitis. The great pressure, estimated at 70 pounds, exerted by the teeth in biting, forces septic matter at the root into the tissues many times a day.

3. Septic matter may be swallowed and absorbed or may set up intestinal irritation.

Besides the ocular lesions mentioned, there is a large group of reflex nervous disturbances, such as headache, earache and insomnia, which can sometimes be traced to the teeth.

The question of the patient's resistance is important, explaining why the same dental disease may cause remote infections in one person and not in another. It is also necessary to consider the virulence of the organism concerned, the amount of toxins absorbed and the length of time the focus has existed.

It will be seen that a proper dental examination includes not only careful inspection, probing, and palpation of the teeth and gums, but a thorough roentgen-ray examination as well, not forgetting the toothless gums. Any less extensive examination is of no value in a diagnostic survey.

Another point on which I have strong convictions is the bearing of dental sepsis on the prognosis of ocular surgery. If, as we all believe, a focus of infection in the mouth can set up an inflammation in a sound and well eye, how much more liable is it to cause trouble in an eye whose resistance is lowered by traumatism, either accidental or surgical. I am satis-

fied that I have seen eyes do badly after operation as the result of an infected tooth, and in which recovery began on removal of the tooth.

I am aware that operators of large experience do not share this view. The ophthalmic department of the Mayo Clinic does not believe in this relation, and in many foreign eye clinics, no attention is paid to the teeth. This was true in Hess' Clinic at Munich, and is still true in the Vienna clinics, at least in Müller's Clinic in the Allegemeine Krankenhaus. On the contrary, Wilmer[1] has the following to say:

"From the hundreds of clinical observations reported, we must believe that infected teeth and many ocular inflammations have a close causal relation. An ophthalmologist who does not give his patient the advantage of these observations fails in his full duty and this is particularly true before intra-ocular operations."

To quote from another oculist of large experience, Col. R. H. Elliot,[2] formerly in charge of the government hospital at Madras in India, speaking of the preparation for a cataract operation:

"The teeth must be seen to and all other sources of auto-intoxication must be excluded."

As a result of some unhappy experiences, I am careful to have the mouths of patients who are to undergo major ocular operations, such as for cataract and glaucoma, put in order, and I would not have such an operation performed on myself without this added precaution against trouble.

Just as we should be alive to search for, recognize and properly treat any form of dental disease that may be at the bottom of a remote trouble in the eye or elsewhere, so should we be awake to the possibility of other causes. As was stated before, just because a person has a bad tooth, it does not follow that that tooth is certainly and solely the cause of his other troubles. The conclusion should not be reached till all other possibilities have been eliminated, not only in the shape of local infections in the abdomen, pelvis, mouth, sinuses, etc., but also in the general condition of the patient, and especially the presence of syphilis and tuberculosis should be considered. Many organs and parts of organs are needlessly sacrificed through misguided enthusiasm. Full many a tooth and tonsil has been needlessly removed because it was wrongly thought to be the cause of an iritis, a headache or rheumatism. A careful examination, comprehensive in character and preceded by an intelligent inquiry into the history, will often keep us from the useless sacrifice of a useful organ.

A few illustrative cases may serve to show the connection that may exist between dental infection and trouble in the eye.

REPORT OF CASES

CASE 1.—Mrs. B., who had been under observation for nearly thirty years, first complained of pain in and between the eyes on using them. Glasses gave her a reasonable amount of relief till 1917, when she began to complain of severe headaches, starting in the forehead and passing to the back of the head. In addition to the attention to the eyes, she was under the care of a good dentist and two very capable physicians. She was carefully examined in every respect, including roentgen ray examination of her teeth, which were constantly under suspicion by all of us except her dentist. The findings comprised a nasal polyp, but no other evidence of sinus trouble, a negative general physical examination and, beginning in 1922, the gradual development of cataracts. From the beneficial effect of ovarian extracts, her trouble was thought to

1. Wilmer, W. H.: Arch. Ophth., 4:453 (Oct.) 1930.

2. Elliot, R. H.: Brit. M. J., 2:1147 (Dec. 21) 1929.

be due to the menopause. Her eyes were examined by two eastern colleagues, but no relief resulted. Finally, a dentist in an eastern city discovered sufficient roentgenologic evidence of trouble to justify the extraction of four teeth in 1927, since which time she has been relieved of headaches.

CASE 2.—Mr. H. began to complain of his left eye in January, 1919. The trouble was diagnosed iritis, and he was treated with the usual remedies. In May, the eye became much worse. I saw him on May 13. The eye was badly inflamed and vision was reduced to counting fingers at a few feet. There was also a rise of tension, thought to be secondary to the iritis. He had several general examinations and laboratory tests without any positive findings. The usual treatment made very little impression on the eye, and because he had had all the teeth extracted, the possibility of trouble in that direction was not at first seriously considered.

May 28, the mouth was roentgenographed, and a root with a granuloma at one end was found embedded in the gum, having evidently broken off in the removal of a tooth. This was at once removed. In two days, the eye was much better and the vision began to improve, while the tension fell to almost normal. Recovery was complete, and when I last saw the patient, three years later, vision in the eye was normal. There was no recurrence up to the time of his death in 1924.

CASE 3.—W. T., aged 57, seen Oct. 17, 1927, complained of failing vision in the right eye of two weeks' duration. Vision was 1/200, which was improved to 15/100 by a + 1 diopter lens. Nothing was found in the general physical examination or in the examination of the blood or of the nose and throat to explain the loss of vision. The eyes were normal inside and outside. The examination of the teeth showed pyorrhea and an old root beneath the gums in the upper molar region. This was extracted, October 29. Vision did not show much change till November 25. It was then 15/30, and with glasses, 15/20. On December 24, the patient's vision was 20/20 and he could read Jaeger's test type 1. The changes in the visual field occurred more promptly.

These three cases are selected as types, and other similar ones could be mentioned, but would not add anything to the presentation of the subject. These cases show not only that the teeth may cause eye troubles of different sorts, but also that one examination is not always conclusive, and that the apparent absence of teeth does not eliminate them as a possible cause of the trouble.

DISCUSSION

Joseph P. Wahl, New Orleans, La.: Many of the leading ophthalmologists of America and Europe have stressed the importance of the part focal infection plays in producing the various eye affections. In all eye diseases, the teeth should be given a careful examination by a competent dentist, who should furnish the ophthalmologist with a complete report regarding his findings. Patients who suffer from pyorrhea or infected teeth will nearly always be affected with corneal ulceration or uveitis. Iritis is a very common form of eye trouble produced by infection of the teeth. No doubt, every one of you has seen cases of ocular disease or visual defects that cleared up after the removal of infected teeth. It might be well to emphasize here the importance of a thorough curettement of all pathologic tissue after tooth removal if one wishes to attain the best results. Tooth infection, as Dr. Ellett has said, may cause retinal hyperesthesia, photophobia and other conditions of the eyes. Tooth infection is usually brought about by failure of the patient to have the teeth examined at specified intervals. This neglect permits the small cavities to become large and finally the decay encroaches on the pulp, which, in turn, becomes infected and finally dies. The infection travels along the pulp canal into the tissue beyond. Pyorrhea offers an avenue for infection by causing the periodontal membrane to become diseased and thus an easy prey to bacteria. Infection may also pass directly into the blood stream. Fabricius Hildanus, several hundred years ago, spoke of the possible relationship between diseases of the eye and teeth. In fact, he reported a case of ophthalmia which he believed was due to an abscessed tooth. Haden's work on relative ocular localization of bacteria from infected teeth, in numerous experiments with cultures grown from the organisms in infected teeth, proved that many of these, when injected into the blood stream, apparently showed a selective affinity for the eye. A. B. Bruner, in a

recent article on diseases of the eye of dental origin, says that, as compared with other foci, dental infection in adults probably ranks first in producing metastatic ocular disease. He also emphasizes the importance of clearing up all tooth infection before undertaking operations which require opening into the eyeball. It is demoralizing to see the diversity of opinion that exists among the members of the medical profession as well as those of the dental profession regarding the status of infected teeth and the effect of their presence on the general health of the patient. Until we come to the same conclusion as to the status of infected teeth and their effect on the general health our patients will not receive the benefits that they should receive from our treatments.

EARLY DEVELOPMENTAL CONDITIONS INFLUENCING RESPIRATORY OBSTRUCTIONS*

By THOMAS M. ROBERTSON, B.Sc., D.D.S., Coffeyville, Kas.

WHEN we speak of development, we naturally think of nutrition. Dumb animals have been endowed with the instinct to select food for the preservation of life. The squirrel sorts its whole grain and various nuts and stows them away for winter roughage. The beaver cuts its bark for its supply of vitamin A. The bee is busy picking its vitamin A out of alfalfa, and the Canadian goose keeps ahead of the storm in order to pick its fresh foods; while we human beings sit at home and allow the grower of fresh fruits and vegetables to pick them before they have matured to their full food value and at a stage where birds or other animals would not consider eating them, so that there will be no financial loss in transporting or marketing. On the same commercial basis, we have allowed the miller to degerminate and remove the mineral and protein contents of the whole grain in preparing our flour and breakfast foods, his commercialized reasoning power telling him that the refined starch and chlorinated white flour will not deteriorate on the shelf.

We might ask: "What has this to do with respiratory obstructions?" It has been only in the last comparatively few years that the nutritional problem has been worked out on a scientific basis and has been correlated with the cell metabolism of the body.

We know that we cannot have healthy tissues or healthy organs unless the cells of that organ are well developed and properly nourished. It is only since the findings of E. V. McCollum,[1] of Johns Hopkins University, Percy G. Howe, Marshall, Price, Wallace,[2] Seccombe[3] and others that we have realized the importance of proper nutriment in building up a healthy physical and mental condition.

Dr. Howe states: "Dental researches

*Read before the Section on Orthodontia at the Seventy-Third Annual Session of the American Dental Association, Memphis, Tenn., Oct. 21, 1931.

1. McCollum, E. V., Simmonds, Nina: Food, Nutrition and Health, Baltimore, 1925.
2. Wallace, J. S.: Newer Knowledge of Hygiene in Diet, J.A.D.A., 18: (July) 1931.
3. Seccombe, Wallace: Nutritional Facts Dentist Should Know, J.A.D.A., 18:1295-1303 (July) 1931.

are in agreement that dental subjects are fundamentally a matter of nutrition. Prevention will be in the field of mineral metabolism: a problem of biology rather than one of bacteriology."

Drs. Howe and Wolboch found that vitamin A especially affects epithelial tissues. In its absence, the normal epithelium of glands[5] and ducts of the respiratory tract and in other parts of the body was replaced by keratinizing or horny

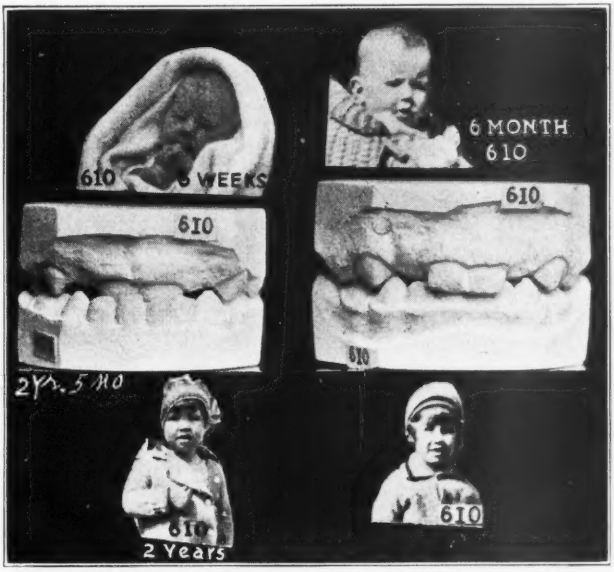

Fig. 1.—Corrected case of mouth breathing. The immediate cause of protrusion, in the picture taken at 6 weeks, was pulling on corner of comforter at the time the teeth were erupting. The pictures taken at 6 weeks, 6 months, 2 years and 3 years, all show continued nasal obstruction to free breathing. Malocclusion was corrected at 2 years and 5 months. The child is of good weight but does not handle food properly. Lack of development in the middle third of the face is evident.

desquamating squamous-cell epithelium. These cells, which frequently filled the ducts and caused the formation of nodules of cheesy matter, are incapable of performing normal excretory functions.

In the experiments on low calcium diets, narrowing of the arches, defects and malposition of the teeth and typical mouth breathing conditions developed. "The nasal passages were greatly restricted and not only had the growth of the bones of the skull and the face been arrested, but the bones had begun to calcify. On the scorbutic diet, the effect was even more pronounced. The maxillary bones of the experimental animals were small and the nasal passages restricted to about the size of a straw."

Until the last ten years or possibly longer, we were inclined to think of rickets as merely a bone disease or an evidence of deficiency of bone development. Now we know that the rachitic

conditions are indicative of a more profound pathologic process almost universally prevalent. We know that the undernourished child is deficient in the structural makeup of its cells. The skeletal structure, because of its requirement of mineral salts, has been the spectacular exhibit.

The importance of free-nasal breathing in the development of the respiratory tract and in the normal development of the face has been underestimated. When we consider that the lungs are the only internal organs that are directly connected with the outside air, free breathing should become as popular as "free wheeling" has in the automobile world.

Dr. Wasson, of the Child Research Clinic, Denver,[4] after making many hundred roentgenograms of children's sinuses, every four months, from birth on, states that these obstructions to normal breathing and development begin very early, within the first few weeks, the influence being more marked as the child grows older.

Many do not get rid of the mucus in the nose and throat at birth, and since it is necessary that the sinus openings get their oxygen with each intake of air, the sinuses soon become infected, the infection extending gradually to the bronchi and the entire respiratory tract.

The child may be irritable and have frequent colds, tonsillitis and nasal discharge, may have a rise in temperature and will probably show the crimson redness of the lining of the nose septum and back of the throat; the typical allergic type,[5] presenting the basic metabolism of acidosis. This type is often dismissed

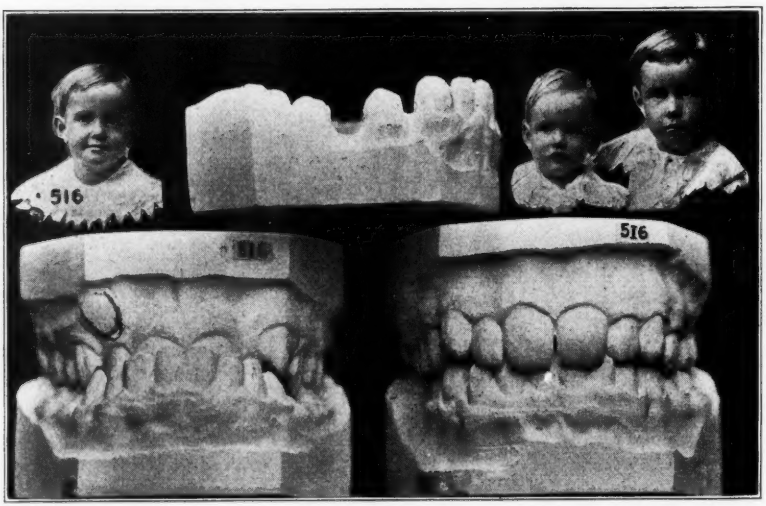

Fig. 2.—Case of short upper lip and lack of development in middle third of face (left). The child at right is a normal breather.

4. Wasson, W. W.: Bronchosinusitis Disease, J.A.M.A., 93:2018-2020 (Dec. 28) 1928.

5. Jarvis, D. C.: Upper Respiratory Tract as a Guide to Nutritional Disaster, Ann. Otol., Rhin. & Laryn., 39:584 (June) 1930.

with the remark, "He has a little cold," or "Most children when they are little breathe through the mouth"; assuming it to be a physiologic condition, rather than the serious pathologic condition that has developed.

Many of these cases can be benefited by the selection of natural foods of alkaline ash reaction. The basic metabolism is disturbed and, unless the condition is corrected, it will develop into the adult asthmatic and hay-fever type.

Let me cite one instance in which the building up of an alkaline reaction over a period of seven months with just three extra oranges a day obliterated a hay-fever condition of over twenty years' standing, allowing the patient (I, myself) free nasal breathing during the ragweed season after all serums had availed not.

These are the patients (Class II, usually) who, after unsuccessful tonsil operations, repeated removal of adenoid

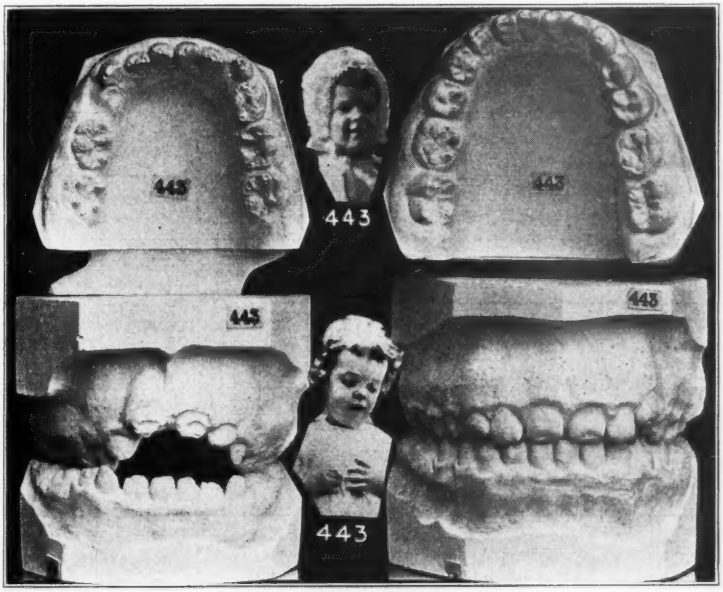

Fig. 3.—Case of early and continued mouth breathing. The weight of patient at birth was 8 pounds; at 1 year, 11 pounds. The metabolism of the mother was poor and that of the child was poor during the first year and a half. The disturbed metabolism is very marked in both the temporary and the permanent dentition. The distinct enamel line established when the child was put under the care of a specialist can be noted. At 1½ to 2 years of age the enamel began depositing normally. The thickened band on the first molar has the appearance of a banded tooth. The bicuspids and second permanent molars, having their enamel deposited at a later date, are normal in their formation. The end of the disturbed period of metabolism is shown on the tips of the anterior permanent teeth; while, in the smaller model (at 8 years), the disturbance is clearly shown on all temporary teeth present. Results of the tongue thrusting habit are evident.

tissue and recurrent malocclusion, live on to haunt the rhinologist and the orthodontist, building up a doubt in the minds of the public as to whether tonsil operations[6] and orthodontic corrections are really worth while.

REPORT OF CASE

W. N., a boy, whose dietary is shown in the accompanying table, has suffered fifty-two bone fractures in his short life. He, as is shown, drank no milk. His mother stated that he ate breakfast food (not shown on nutritional chart) with "lots of sugar." His teeth were "broken off and very black." His mother asked if it would "do" to have the teeth extracted.

NUTRITIONAL CHART IN CASE REPORTED

DAY	BREAKFAST	DINNER	SUPPER
Monday	Cup of coffee	Corn, potatoes, potato salad	Green beans, potatoes, meat, pie, 2 glasses of tea
Tuesday	Cup of coffee	Peas, potatoes, fruit salad	Potatoes, meat, cake, 2 glasses of iced tea
Wednesday	Cup of coffee	Beans, potatoes	Peas, meat, potatoes, banana and pineapple
Thursday	Cup of coffee	Tomatoes, potatoes and meat	Corn, meat, potatoes, ice cream, 2 glasses of lemonade
Friday	Cup of coffee	Green beans, potatoes	Potatoes, meat, tomatoes, pie, 2 glasses of iced tea
Saturday	Cup of coffee	Corn and potatoes	Beans, meat and potato cake
Sunday	Soft boiled egg, piece of toast, cup of coffee	Chicken, peas, potatoes, jello	Corn, meat, dessert, potatoes, potato salad

CONCLUSIONS

1. Healthy, well-nourished, normal functioning cells are necessary to produce the specialized functioning cells (secretory and epithelial, ductless glands, lymphoid tissue, etc.) in the prenatal and early developmental period.

2. In order to be healthy, it seems advisable to be as careful in selecting grandparents as it is in selecting parents.

3. The two conditions interfering most with normal respiratory conditions are (1) the allergic type of congestion and (2) infections. The infections occupy a secondary place possibly and are really an end-product of a faulty nutrition.

4. The findings of our national dental research commission and recent medical research would indicate that all the elements necessary for development, growth and maintenance of the human body are supplied by Nature in the dairy products and the products of the soil when served as Nature prepared them.

6. Fenton, R. A.: Noninfectious Factors of Etiology of Sinus Disease, Ann. Otol., Rhin. & Laryn., 39:493 (June) 1930.

5. The public health requires a closer cooperation between physician and dentist in educating the general public regarding the nutrition and the metabolism of the body.

6. Free nasal respiration is necessary to develop and keep paranasal sinuses healthy.

7. The use of natural foods which will maintain an alkaline, basic salt reaction will benefit all cases and is almost a specific for allergic types.

CARE OF THE SOFT TISSUES SURROUNDING THE TEETH OF CHILDREN*

By BENJAMIN KLETZKY, D.D.S., Pueblo, Colo.

TRITE though the axiom may be, an ounce of prevention is still worth a pound of cure. Though the bulk of dentistry today is in the nature of the restoration of lost parts of the mouth owing to the inability of our profession to administer the "ounce of prevention" in the nick of time, or perhaps the unwillingness of the tooth-bearing populace to accept that same "ounce of prevention" though we honestly endeavor to administer it, a great deal of thought and action are being expended in an effort to prevent the inception of dental disease, with the consequent necessity of extensive restorative work, and thus enable our young patients to grow old without the fear and expectancy of the loss of the natural teeth.

It has been my observation that normally a healthy periodontium is associated with sound tooth structure. This is a logical condition, for the means at our disposal, at the present time, of maintaining the soft tissues in a state of health are such that their use of necessity benefits the adjacent hard tissue. Therefore, the first step to be taken in the prevention of tooth disease and subsequent crippling of the dental mechanism is proper care of the soft tissues. By proper care, we mean not only adequate professional attention in our offices, but also adequate, intelligent instruction for home care after the patient leaves the office. Why a vast majority of the dental profession seem to be of the opinion that oral hygiene instruction is something which must be withheld from the patient until maturity is reached, and even later, is beyond me. The majority of our dental disorders have their inception between the ages of 6 and 16, and, in the light of our present knowledge, for the most part these disorders are absolutely preventable if adequate steps are taken to prevent them before they occur. Our patients are under our personal care for perhaps from five to eight hours, at the most, out of a possible 8,760 each year. What is happening to the teeth and soft tissues when the patient is not in our office? *That* is our problem, and our patients are daily challenging us to solve it.

That our children may be blessed with healthy mouths capable of withstanding the onslaught of infections to which they are constantly exposed, it is necessary to

*Read before the Section on Periodontia at the Seventy-Third Annual Session of the American Dental Association, Memphis, Tenn., Oct. 22, 1931.

start first with the expectant mother. A sound structure cannot be erected upon a weak foundation. Cooperation with the family physician in the matter of establishing a dietary régime which is best suited for building sound tooth structure and sound surrounding tissues is most desirable and welcome.

After the birth of the child, the dentist can be invaluable in giving instruction to the mother as to the proper care of the tissues of the mouth, insuring oral comfort and health to the child. A thorough cleansing of the oral tissues should be instituted daily, preferably following the baby's bath. This should be accomplished by wrapping the forefinger with cotton to form an easily manipulated swab, dipping this swab in a weak sweetened solution of boric acid and gently rubbing the gums, the tongue and all mucous membranes lining the mouth. This will suffice until the deciduous teeth begin to put in their appearance. On the eruption of the deciduous teeth, a tiny brush of medium texture, moistened with a pleasant dentifrice, should be resorted to, and daily massage of the soft tissues surrounding the teeth should be instituted, to aid in maintaining healthy tissue tone and also to remove the plaque which is prone to accumulate on the teeth, bringing about early decalcification and subsequent caries, which may result disastrously. On the eruption of the full complement of deciduous teeth, the use of dental floss should be added to the routine daily care of the mouth in order to avoid impingement of fibrous foods on interproximal gingival tissue and possible subgingival abscess formation.

The completion of the eruption of the deciduous dentition is the signal for instituting regular visits to the dentist for prophylactic care. From that time on, the child should be seen every three months, the teeth being thoroughly cleaned and polished with a rubber cup and silex and the interproximal surfaces carefully taped. In the mouth of the normal healthy child, this care will be all that is necessary to maintain a state of gingival tissue health, aside from the operative procedures necessitated through caries. The home care of the child's mouth should be seen to by the parent until such time as the child is capable of doing the work itself. As soon as it is deemed advisable, perhaps at the age of 5 or 6 years, the child should be taught to care for its own mouth, the dentist being careful to impress the child with the value and necessity of daily scrupulous care. Parents are grateful for the attention the dentist gives the child, and the regular routine visits can be easily arranged and maintained through establishing a call list for the purpose of informing the parents when the child is due for its regular prophylactic care.

So far, I have stressed the importance of instituting early care and early instruction in the care of the oral cavity. I shall now go into some of the phases of the maintenance of health in the gingival tissues, together with some of the causes of the inception of diseased conditions which come within the province of daily practices. These causes are: (1) faulty operative procedure; (2) hypertrophic gingivitis; (3) changes manifest in gingival tissue through dietary deficiency; (4) stomatic ulcers; (5) gingival recession; (6) calcareous deposits, and (7) Vincent's infection.

These I will discuss separately, though in their bearing on the health of the soft tissues they may overlap.

FAULTY OPERATIVE PROCEDURE

Faulty operative procedure is one of the commonest causes of gingival irrita-

tion, with its resultant complications, and, on the other hand, is a cause which can be entirely eradicated through conscientious attention to detail when operative procedures are instituted. The feeling that operative procedures, meaning, of course, the replacing of lost tooth structure due to caries or other causes, in the mouths of children, do not require the minute attention to detail that must be given to the same procedures in the adult dentition is one to be dispelled. Too often, the operator makes the restoration with the thought that it is but a temporary expedient to be improved on in the future, while the patient labors under the delusion that it is a finished product and gives that area no further thought until trouble develops. This is a condition that must be remedied. Unless occlusal surfaces, marginal ridges and proper interproximal contour are restored, with the proper positioning of the contact point and careful trimming of the gingival margins so that no overhang or roughness remain to bring about gingival irritation and impingement, a condition is set up which will always result in injury to the tissues surrounding the tooth. Too often, the pyorrhea pocket diagnosed at 25 is one which had its inception ten to fifteen years earlier through the carelessness of the operator attempting to restore lost tooth structure.

In the light of the improved methods of operative procedure within the scope of every dentist, there is no excuse for a restoration which will result in injury to the soft tissues. Those patients that appear unmanageable when cavity preparation is being attempted are easily handled through the use of local anesthesia. The improved casting technic places at our disposal a method of restoration in cases involving a great loss of tooth structure by which correct contour is assured and thus the protection of the gingival tissue afforded as with the tooth of normal contour. In the restoration involving the buccal or lingual surfaces of teeth, the contour should be such as to restore the normal tension of the dental ligament and at the same time afford protection of the gingival tissue against injury due to the excursion of foods on these surfaces.

The foregoing refers mainly to restorative work on the permanent teeth in the mouths of children. The same careful procedure is indicated in the care of the deciduous teeth. Interproximal restoration in the deciduous teeth should be carried out that there will be no impingement on the interproximal gingival tissue, and firm, well-placed contact points are assured. Unless this is done, food impaction, coupled with gingival irritation due to tissue impingement through overhanging gingival margins, will result in a chronic gingivitis and often gingival abscess formation, which frequently results in unfavorable systemic reactions. The toxins absorbed from gingival irritation in the mouths of children can be pointed to as a factor in heart lesions, rheumatic conditions and many other systemic disorders which do not make themselves evident until adult life.

HYPERTROPHIC GINGIVITIS

Hypertrophic gingivitis, one of the first symptoms of impending periodontal disturbance, manifests itself early in the mouths of many children, and too often goes untreated until irreparable damage has been done. Though seldom seen in the deciduous dentition, it is a common condition about the upper and lower anterior permanent teeth, occurring as early as the eighth year. It is usually the result of faulty mouth hygiene which allows the formation of both salivary and

serumal calculus on the teeth in the affected region. The tissues take on a swollen, glossy, reddened appearance, bleeding easily on the slightest manipulation. If the condition is neglected, there is a proliferation of tissue growth which, at times, will completely cover the gingival third or even half of the teeth involved. Unless treatment is early instituted, definite periodontal destruction will ensue. Roentgenographic examination of many of these cases shows destruction of the alveolar crests and the adjacent pericemental membrane resulting in the establishment of a periclastic condition, which can, no doubt, account for the early loss of the four anterior teeth in adult life which is so often seen.

Treatment for this condition is comparatively simple and its prophylactic result is of untold value. A thorough apoxesis must be performed, with careful scaling of the involved root surfaces to remove every vestige of deposit. The surfaces should then be thoroughly polished with fine cuttle strips and flat dental tape impregnated with a fine silex. The patient should be carefully instructed in a brushing technic which will be adequate for the prevention of further accumulation of deposits. This treatment will usually suffice to clear up the condition, after which it should be carefully watched and treated at each subsequent prophylactic visit. It is necessary in some of the cases of extreme hypertrophy to resort to conservative surgery. If this is deemed advisable, the part is anesthetized and the excess tissue is excised to a point slightly above on the lower, and below on the upper teeth, at what would be considered normal gingival height.

When traumatic occlusion due to irregular alinement may be a contributing cause, orthodontic treatment should be undertaken.

CHANGES MANIFEST IN GINGIVAL TISSUE AND DUE TO DIETARY DEFICIENCY

A condition of the gingival tissue surrounding the deciduous teeth which manifests a most distressing clinical picture, and which returns to health most rapidly under proper treatment, is one evidently brought about by a dietary insufficiency. Clinically, such cases present bleeding and swelling of the gingival tissue, the margins of which had a frayed, thin grayish white appearance, with spontaneous hemorrhage. Adjacent to the grayish white area of hemorrhage, the gingiva is a deep reddish purple. The slightest pressure induces hemorrhage. The lining membrane of the oral cavity may also be involved and the lips are puffy and darkened, with frequent breaks in the membrane, also bleeding easily. Bleeding from the nose often accompanies this condition. The presence of Vincent's organisms in great numbers has been noted. The child has no appetite and shows symptoms of general malaise. I have seen this condition in children as young as 18 months, but seldom in children past 6 years of age. On inquiry, it has always developed that the diet has been notably lacking in fruits, vegetables and even whole milk, being made up principally of cereals, beans, bread and eggs.

By placing the child on a diet consisting of orange juice, whole milk and leafy fresh vegetables, along with a routine of treatment in the office, a rapid recovery will be brought about. It is well in cases of this type to work in conjunction with the family physician. The office treatment consists of cleansing the oral cavity as thoroughly as possible by gentle spraying with an antiseptic mouthwash and swabbing the involved tissues with a 5 per cent solution of chromic acid followed immediately with full strength

peroxid. Home care through thorough rinsing of the mouth with the mouthwash is instituted. No brushing is advised; in fact, the toothbrush is destroyed on request. Office treatment is given daily for three days; after which, intervals of forty-eight hours elapse between treatments. At the end of a week, all symptoms have usually disappeared. A thorough prophylactic treatment should be given and the patient should be dismissed.

STOMATIC ULCERS

Stomatic ulcers, or the condition known as aphthous stomatitis, are frequently seen in the mouths of children. They are the cause of a great deal of discomfort on the part of the child and much alarm on the part of the parent. The ulcers have a yellowish white appearance, are quite shallow and are extremely painful. They occur on the mucous membrane of the cheek, lips and tongue. The tip of the tongue and the mucous fold made by the junction of the submucous tissue and the tissues of the cheek seem to be the usual locations for such lesions. I have frequently observed them in the floor of the mouth also, adjacent to the sublingual and submaxillary duct orifices. These ulcerations usually occur as a result of digestive disturbances and are readily amenable to treatment. Local treatment consists of carefully touching the ulceration with phenol. The parent should be advised to administer a mild cathartic to the child.

GINGIVAL RECESSION

Very often children present a marked gingival recession in the region of one or more of the lower permanent anterior teeth and in the region of the upper and lower first permanent molars. These lesions appear to be entirely traumatic in origin. They are more pronounced on the labial and buccal surfaces than elsewhere. In the molar region, there is nearly always evident a tipping of the upper first molar mesially, which would tend to set up traumatic interference. In the incisor region, this condition is most often found where there is a bunching of the lower incisors, the recession occurring on the incisor in the farthest labial version. The presence of an upper incisor in lingual version will also tend to produce gingival recession in the lower incisor region. There is usually present a small deposit of serumal calculus just under the gingival margin. There is a notable lack of pus formation.

The treatment consists of a thorough scaling and polishing of the teeth involved, accompanied by instruction as to brushing, so that no further mechanical injury may be done by improper brushing technic, and the correction of the traumatism through grinding the involved teeth, or orthodontic treatment where deemed advisable.

CALCAREOUS DEPOSITS

Early examination of the teeth of children in an attempt to detect the formation of calcareous deposits subgingivally is imperative, for though all children do not present such deposits, especially in early childhood, the incidence of serumal calculus on the teeth of children is frequent enough to warrant a thorough examination for its presence each time the patient is seen. If calculus is allowed to remain on the tooth undisturbed, the surrounding tissues undergo the same inflammatory changes that occur in the adult mouth under a like condition, and the inception of a pyorrheic tendency is inevitable.

Wherever these deposits are found, they must be removed by careful scaling, the accessible surfaces should be polished

thoroughly with the rubber cup and fine silex and the interproximal surfaces should be polished with dental tape impregnated with silex powder. Traumatic occlusion should be looked for and corrected.

VINCENT'S INFECTION

Though Vincent's infection occurs in mouths of patients between the ages of 20 and 50 in the greatest frequence, its incidence in the mouths of children is frequent enough to warrant some thought and time being devoted to the discussion of its care.

Bacteriologic studies have shown in children the almost total absence of the spirochete of Vincent and the fusiform bacillus from mouths that are kept in a clean, wholesome condition. On the other hand, unclean mouths show these two inciting organisms in upwards of 60 per cent of the cases. From these facts, it can be readily deduced that this type of infection is one which is most often associated with oral filth; which leads one to assume that the most certain means of prevention is strict oral hygiene. This is borne out in the study of adult cases.

Vincent's infection in the mouths of children presents the same clinical picture that is found in the mouths of adults, with a much more rapid onslaught and usually a greater involvement of the surrounding tissues. The case usually presents a history of loss of appetite, rise in temperature and spontaneous hemorrhage from the mouth and even the nose. The grayish slough involves not only the gingival tissue but the mucous membrane of the cheeks and lips as well. The destruction of tissue is so rapid that, in place of the interdental crater-like erosions so characteristic of Vincent's in older patients, there is a general fraying and erosion of the gingival tissue throughout the mouth.

Though the intensity of the infection in the mouths of children may be more severe, its response to treatment is much more rapid than would normally be expected.

The treatment which has been most successful in my hands is as follows: The mouth is sprayed gently but thoroughly with a mouthwash of the following formula: Wine of ipecac, 6 drams; liquor potassii arsenitis, 10 drams; glycerin, 10 drams; hydrogen peroxid to make 16 ounces.

This is used full strength. Thereafter, the mouth is swabbed thoroughly with 5 per cent chromic acid followed immediately with full strength peroxid. Brushing is forbidden until the tissues are sufficiently healed to allow it. Home care consists of washing the mouth with the foregoing mouthwash every three hours.

With this treatment, relief is almost immediate, and the patient becomes quite comfortable within twenty-four hours. The treatment is repeated daily for three to four days, and then every forty-eight hours until all symptoms disappear, which is usually within from a week to ten days. Final dismissal of the patient is dependent on the absence of the Vincent's organisms in bacteriologic smears.

Vincent's infection in children's mouths, which is often secondary to some general systemic debility, should be suspected in those cases of gingival inflammation that are difficult to clear up.

Even though the profession as a whole has been cognizant of the presence of these disturbing conditions in the child mouth, too little importance has been attached to them. If true preventive dentistry is to be practiced, it is essential that more specific attention be paid to the various inflammatory conditions found in the mouth of the child and more time be devoted to their eradication.

HYPERTROPHIC GINGIVITIS—ITS CLINICAL ASPECT*

By ISADOR HIRSCHFELD, D.D.S., New York City

THE clinical aspect of periodontology presents no phase more interesting or intriguing than that of hypertrophic gingivitis. Its symptoms are numerous and dissimilar. It runs the gamut from an almost intangible increase in bulk of gum tissue to striking proportions. In some types, the gingivae are hard, pink, stippled and in every other way normal in appearance except for the hypertrophy; while, in others, they may be semifirm, soft or partly necrotic. They may not feel at all tender or they may be either tolerably sensitive or very painful. They may differ considerably in color from pale to bright red, and may change successively in proportion to the progress of the disease, as in scurvy, in which the color changes from old rose to red, then to purple, blue and bluish black.[1] In certain types, the gingivae cannot be made to bleed easily; while, in others, they bleed on the slightest pressure or injury, or even spontaneously, the bleeding in some cases being difficult to control.

The etiologic factors of these symptoms are equally diverse, but may, in general, be classified as local and systemic. While, in some clinical entities, only the local traumatizing agencies appear to be responsible for the hypertrophy, and, in others, only the systemic, the presence of both is usually disclosed on closer observation, although one or the other may be conspicuously predominant. Thus, in mouth breathing gingivitis, although the local conditions alone seem to be responsible for the pathologic condition, the nutritional element too requires consideration. Similarly, in pregnancy gingivitis or in scurvy, in which there is no doubt about the important rôle played by systemic disturbances, the influence of the local irritants is evidenced by the localization of the hypertrophy. In other words, in the latter instances, the gingival hypertrophy is a symptom of a systemic condition which expresses itself at favored points of local irritation, no matter how comparatively infinitesimal; whereas, in the former, the hypertrophy is caused primarily by local irritants, which seem to be especially effective when there is a concomitant predisposing systemic condition.

The diagnosis and treatment of the following types of hypertrophic gingivitis will be discussed herewith: 1. Hypertrophy of the papilla between the lower lateral incisor and the adjacent overlapping cuspid. 2. Hypertrophy in the anterior part of the mouth caused by the teeth standing in torsion. 3. Mouth-breathing gingivitis. 4. Hypertrophy produced by mechanical trauma through the extreme overlapping of the opposing anterior teeth. 5. Hypertrophy associated

*Read before the Section on Periodontia at the Seventy-Third Annual Session of the American Dental Association, Memphis, Tenn., Oct. 21, 1931.

1. Hirschfeld, Isador: Scurvy, a Report of Three Cases in Adults, J. A. D. A., 16:796 (May) 1929.

with pregnancy. 6. Hypertrophy due to an atypical Vincent's infection. 7. "Primary" or "true" hypertrophic gingivitis. 8. Hypertrophy caused by scurvy. 9. Hypertrophy caused by mercury. 10. Hypertrophy associated with leukemia.

It is obvious that, in order to be able to cope intelligently and successfully with such varied types, one must not only be fairly familiar with their differential diagnoses, but must also have at least a working knowledge of the known possible systemic factors and a clinical appreciation of the detection and elimination of local etiologic conditions. The local

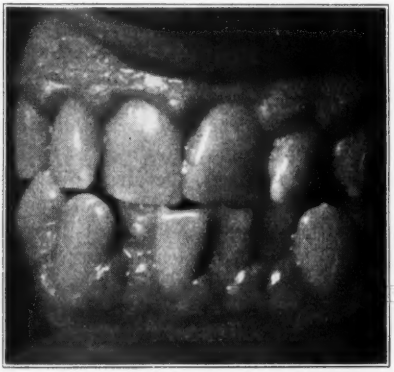

Fig. 1.—Hypertrophy with overlapping position of anterior teeth. (Illustrations in this article have been copyrighted by the author as they are to be used in his forthcoming book "The Toothbrush—Its Use and Abuse.")

conditions may be divided, broadly, into those which directly irritate or traumatize and those which otherwise produce an adverse effect on the local circulation. More specifically, some of these may be listed as follows: 1. Abnormal anatomic relationship of a tooth to its adjacent neighbor. 2. Abnormal anatomic relationship of a tooth to its opponent. 3. Lack of local function. 4. Lack of local hygiene. 5. The presence of subgingival calculus. 6. The presence of subgingival or cervical cavities or margins of cavities. 7. The presence of subgingival or cervical overhanging margins of fillings or crowns. 8. Food impaction. 9. Pressure of either fixed or removable appliances. 10. Traumatic occlusion. 11. The presence of bacteria, essentially the Vincent organisms. (Various writers also report the finding of fungi, on biopsy, and Roe[2] proposed to call one case reported by him "saccharomycosis" because he believed it was caused by saccharomycetes.) 12. Dryness of the gingival mucous membrane. 13. Friction of the gingival mu-

Fig. 2.—Mouth breathing gingivitis in a boy of 16. The papillae were red and swollen and could be made to bleed easily. Pseudoclefts are produced by the approximation of the adjoining papillae in the lower jaw.

cous membrane by air, through mouth-breathing.

A close acquaintance with the foregoing should serve at once as an aid both in diagnosing the major or minor etiologic entities in individual cases and in suggesting the procedure in treatment that will bring about a permanent reduc-

2. Roe, W. J.: Hypertrophy of Gums, D. Cosmos, 43:341-350 (April) 1901.

tion of the hypertrophied tissues.

To illustrate in a practical way the manner in which these conditions contribute individually or collectively to the establishment of hypertrophic gingivitis, let us analyze the development of the hypertrophy, by way of demonstration, of the first type, one of the simplest forms so frequently met with, the hypertrophied papilla between the lower cuspid and the adjacent lateral incisor when the former tilts somewhat mesially, overlapping the latter labially. (Fig. 13.) If toothbrushing is thoroughly carried out at this point, or if the patient uses a fair amount of coarse food and less of the refined, sticky variety, the papilla under consideration

Fig. 3.—Case shown in Figure 2; one year later, after conservative treatment had been carried out.

will probably remain normal even under the abnormal anatomic condition; but when the reverse is true, some of the etiologic factors mentioned above become operative as follows: Because the cuspid is inclined, and the embrasure between it and the incisor is emphasized, this area is protected from the cleansing action of food. If the unhygienic condition thus produced is not corrected by proper toothbrushing, a nidus for bacterial growth is permitted to remain undisturbed. Decomposition of the food lodged here soon takes place. The gingival tissue is then subjected to irritation by bacteria, bacterial products and the end-products of food decomposition. The resulting inflammation is fostered by lack of massage during mastication because of the abnormal position of the cuspid. In addition, since the contact point here is close to the alveolar crest, the interproximal space and papilla are correspondingly small.[3] Consequently, the vascular equipment is dwarfed and has, therefore, difficulty in disposing of the inflammatory products. A slow seepage of blood into the gingival crevice eventually takes place, with the subsequent formation of a subgingival layer of calculus, which, in turn, inflicts a twofold injury: first, it

Fig. 4.—Hypertrophy due to close approximation of lower teeth to palatal gingiva. Food impaction and proximal caries were contributing conditions.

becomes a mechanical irritant to the overlying gingiva and, secondly, its projection into the soft tissue helps to promote an additional degree of stasis, with hypertrophy as the inevitable result.

TREATMENT

Generally speaking, treatment of chronic hypertrophic gingivitis is carried out along the same lines as that of suppurative periodontoclasia (pyorrhea).

3. Hirschfeld, Isador: Food Impaction, J. A. D. A., 17:1508-1509 (Aug.) 1930.

The patient's condition is considered from the systemic point of view as well as from the local, with the idea of promoting an improved general condition of bodily health. The physician's aid is enlisted wherever indicated. The habitual use of soft, sticky food is discouraged and a greater amount of coarse food is prescribed (unless contraindicated by gastrointestinal disease). Diet is corrected only when found conspicuously inadequate. In none of the cases used in the accompanying illustrations was any particular type of food strongly stressed. This is merely a statement of fact which should not be misconstrued as a disparagement of the excellent work on nutrition with

Fig. 5.—Hypertrophic (proliferative) gingivitis of pregnancy. The swollen papillae and protruding subgingival proliferations; also, the inflamed, fringed appearance of the marginal gingiva near the lower right incisors may be noted.

relation to periodontal disease, being conducted by Hanke and others.

Experience indicates that, in all cases of hypertrophy, especially when an inflammatory condition is evident, it is good policy to suspect that Vincent's infection is associated with the condition as either a major or minor contributing factor. Therefore, it becomes advisable to institute, at first, a course of treatment of the Vincent's for several days. The drugs used for this purpose must not include any acids or other escharotics. (Astringent mouthwashes are seldom indicated.) The mouth then receives a general preliminary cleansing, including the removal of the larger subgingival deposits. This operation causes free hemorrhage and is a practical means of "blood-letting," as it were, which produces a partial disgorgement of the fluid content of the gingiva, thus reducing the bulk of the hypertrophy markedly within a short time. The additional loss of blood through repeated gentle subgingival curettage at subsequent visits further decreases the swelling and the color tends to become normal. This is continued until there is no further bleeding when instru-

Fig. 6.—Case shown in Figure 5 but greatly improved, before childbirth. The lower gingivae are entirely well; the upper, although not completely normal, are almost so in color and contour.

ments are introduced into the gingival crevice.

The operator must bear in mind that this must entail a minimum of traumatization and that the hemorrhage should be quite spontaneous, occurring on the mere pressure of the instruments against the gums, incidental to tooth curettage. In this procedure, after the tooth surface has once been thoroughly cleaned, the instruments are used very lightly to remove any recurring deposits of extraneous material. Shaving of the root sur-

face is especially avoided. To preclude unnecessary exposure of the root surface after the hypertrophy has disappeared, the operator must guard against detachment of the gingiva. This operation also should involve little or no pain, but, to insure minimum trauma, it is carried out preferably without any anesthetic.

Subsequently, the hypertrophy continues to decrease, essentially through the stimulating effect of continued proper toothbrushing, in which the patient had been instructed soon after the preliminary cleansing. For this purpose, the Charters method is preferred. Brushing must be done thoroughly, approximately five times a day, but especially after meals, the chief objectives being hygiene and stimulation. All additional local irritants are eliminated or at least reduced to a minimum. The use of tobacco and condiments should be temporarily reduced or completely dispensed with, if possible. All cavities are filled, especially the cervical and interproximal, and overhanging cervical margins of fillings and crowns removed. Food impaction and traumatic occlusion are reduced.

Throughout the entire course of treatment, the operator must bear in mind that the toothbrush is his most potent ally, and the patient must be impressed likewise. For this reason, periodic checking up on the frequency and the thoroughness of the brushing process is very urgent.

As a result of the course of treatment above outlined, there is an early and rapid decrease in the bulk of the gingival tissue, also a favorable change in the color, but the remaining hypertrophy may in some instances disappear more gradually. Where such a response is not noticeable after all known local etiologic conditions have been eliminated, which happens but rarely, surgical interference is usually indicated.

The types of hypertrophic gingivitis above listed may be treated in this way, with modifications according to the re-

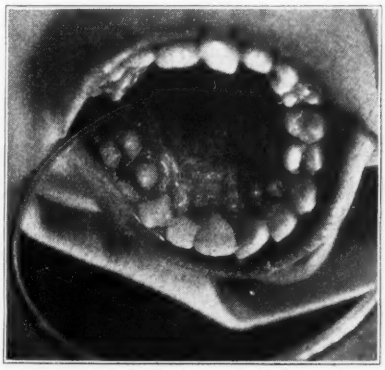

Fig. 7.—Case shown in Figures 5-6; palatal side. The areas of gingival proliferation were extremely annoying both during the day and through the night.

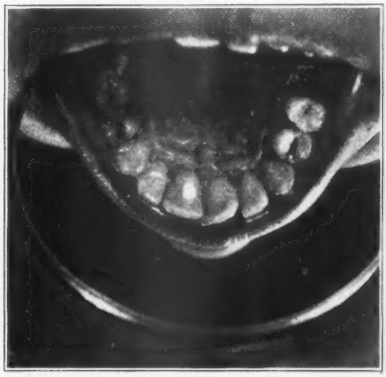

Fig. 8.—Case shown in Figures 5-7; after treatment, but before childbirth. In place of the former marked swelling of the gum, there are now only minute innocuous remnants of areas of interproximal subgingival proliferation.

spective requirements as noted in the descriptions that follow:

1. Hypertrophy of the interdental papilla between a lower lateral incisor and the adjacent overlapping cuspid (Fig. 13). The overlapping mesial angle of the cuspid is reduced considerably by grinding (precaution being taken not to cause sensitiveness), to enhance the massaging action of mastication and to promote hygiene at that point. Food impaction, frequently associated with this abnormal anatomic condition, should also receive due attention.

2. Hypertrophy in the anterior part of the mouth caused by the teeth standing in torsion (Fig. 1). This condition is similar to that of type 1 except that more teeth are affected. There may also be the additional factor of habitual exposure of the gingivae to the air, either because of shortness of the lip or of abnormal habits. While this pathologic entity is frequently seen in the white race, Bert G. Anderson,[4] formerly of Peking Union Medical College, now of Yale University, states that observation on more than 5,000 Chinese indicates that the condition, in various degrees of development, is exceedingly common among these people. It is interesting to note, from the casts in his illustrations, that the mouth which showed normal gingivae is the only one in which the anterior teeth were not overlapping. This seems to verify my diagnosis of this irregularity as an etiologic condition.

Fig. 9.—Pregnancy "tumors." Those shown here were pedunculated. The one between the upper right cuspid and first bicuspid reached the occlusal plane of the teeth below and closely covered the alveolar gingiva above. The center was bluish pink and the fringed edges bright red. It extended interproximally to the palatal side, temporarily forcing the teeth apart.

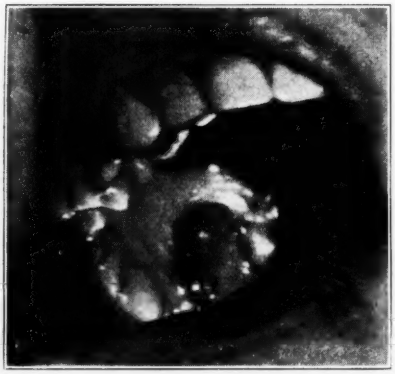

Fig. 10.—Pregnancy "tumors" shown in Figure 9. The proliferations emanating from the septal tissue between the cuspid and bicuspid were extended in a series of three generations across the palate, the granddaughter "tumor" reaching the median line. Of semirigid consistency, they hugged the palate closely. While these could easily have been removed with the knife, it was interesting to watch the sequence of events in the disappearance as a result of conservative treatment. In addition to routine treatment, the tumors were lightly massaged by the patient's finger. Soon after beginning of treatment, they withered away, one at a time, the distal one disappearing first.

4. Anderson, B. G.: Hypertrophic Gingivitis Among Chinese, Nat. M. J. China, 15: 453-454 (Aug.) 1929.

Dr. Anderson, on my inquiry, corroborated my assumption that the gums and teeth must generally be exposed to the air because the lips are separated. He thought this was due to the position rather than to the shortness of the lips, as they are not shorter than those of the Caucasians. He stated that they are not necessarily mouth breathers.

It is common knowledge that all mucous membranes must be kept moist and that a continued or frequent state of dryness is a source of irritation. In the case of the gingival mucous membrane, such continued irritation tends to cause hypertrophy, especially when the circu-

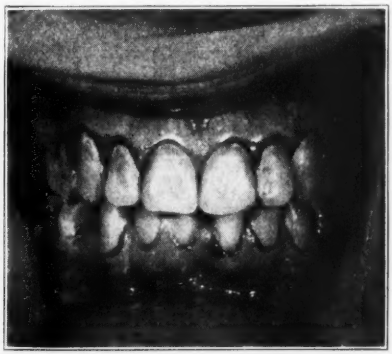

Fig. 11.—Pregnancy "tumors" shown in Figures 9-10; three months after childbirth. As the patient did not continue home care of the mouth, the condition remained the same and this photograph shows approximately how the gingiva looked prior to parturition. One "tumor" had entirely disappeared and there was but a slight remnant of the other.

latory outfit of the gingivae is below par on account of the irregularity of the teeth. In some cases, orthodontia is indicated in addition to the routine treatment for hypertrophic gingivitis.

3. Mouth breathing gingivitis. In this, the palatal gingivae are irritated by the friction of the current of air in respiration; in other words, the air as it is inhaled and exhaled, acts as a sort of rasp, traumatizing the more or less dry mucous membrane. The hypertrophy is limited usually to six or eight anterior teeth, while the posterior part of the mouth remains entirely unaffected. The labial gingivae, if not exposed to the air, are generally not hypertrophied, but the inflammation may extend from the hypertrophied palatal gingivae through the septal tissue to the labial side. The buckling of the dental arches, characteristic in most mouth breathers, and the resultant malposition of the anterior teeth, may cause the labial gingivae also to become greatly hypertrophied, the papillae especially being affected (Figs. 2

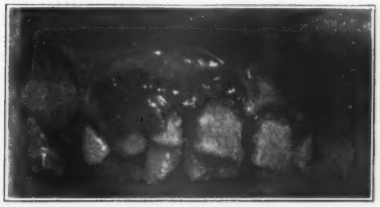

Fig. 12.—Proliferative gingivitis in a male (L. B. Rosen's patient at the Periodontia Clinic in the New York Hospital for Joint Diseases), the affected area resembling in color, form and consistency very closely the pregnancy "tumor" in Figure 9. The mass of tissue, covering the lateral incisor and the cuspid, is pedunculated, being attached on the labial aspect of the septal tissue between the two teeth. The patient had no posterior teeth on either side, but chewed with the broken down cuspid and first bicuspid roots on the left side. The right side was not used and the upper lateral incisor was extremely traumatized by the lower cuspid. Biopsy revealed chronic inflammatory tissue with polyp formations.

and 3). The two types mentioned above are differentiated from other types of chronic hypertrophic gingivitis by their location about the six or eight anterior

teeth, and the former is differentiated from the latter essentially in that there is no history of mouth breathing, past or present.

In the mouth breathing gingivitis, treatment as outlined above should be supplemented by a correction of the mouth breathing through the removal of nasal obstructions. If that has already been done, but the mouth breathing continues through force of habit, it is sometimes desirable either that the lips be kept closed at night by means of some contrivance, during the period of treatment, or that the gums be coated with white petrolatum (vaselin). The ideal procedure should include orthodontia, where indicated. When mouth breathing and continuous exposure of the gum cannot be entirely corrected, treatment, although more lengthy and difficult, may nevertheless be more or less successful if the patient uses the toothbrush properly. The continued proper use of the brush after the completion of treatment is effective too in preventing a recurrence of the hypertrophy.

Fig. 13.—Hypertrophic gingivitis caused by recurrent subacute Vincent's infection. The swollen papillae between the lower lateral incisor and cuspid on each side have regenerated, after surgical removal.

4. Hypertrophy produced by mechanical trauma through the extreme overlapping of the opposing anterior teeth (Fig. 4). In this condition, the upper teeth overlap the lower so closely in centric occlusion that the incisal edges of the lower strike and injure the opposite palatal gingiva directly, or, through the bitten-off morsel, indirectly. The labial gingiva of the lower jaw may also be traumatized similarly by the upper teeth, with a resultant hypertrophy there too. Additional periodontal trauma in the lower incisor region may result from the overwhelming occlusal leverage produced on the lower teeth as they strike the upper incisors at or beyond the cingulum. In addition to the usual treatment for chronic hypertrophic gingivitis, the abnormal occlusal relationship should be reduced considerably by orthodontia or by raising the bite. In some instances, judicious grinding is helpful. Since food impaction, interproximal caries and the presence of overhanging margins of fillings frequently accentuate the hypertrophy, these should also be corrected.

Fig. 14.—Case shown in Figure 13 after treatment of Vincent's infection.

5. Hypertrophy associated with pregnancy. Pregnancy tends to manifest itself through the gums in several ways; namely, marginal gingivitis (ranging from old rose to bright red), hypertrophy of the gums, especially the interdental papillae, and proliferations from under the gum either interproximally or, less fre-

quently, on the labial or lingual sides. Pregnancy may also produce an acceleration in the growth of preexisting gingival neoplasms as well as that of a preexisting gingival hypertrophy. The form which most commonly claims the attention of the dentist is the proliferating type, in which there is a general tendency to proliferation of the gum tissue in small or large masses (Figs. 5-9). These may be sessile or even pedunculated. It is probably for that reason that Garretson,[5] in 1890, used the term "proliferative gingivitis in pregnancy" in describing the gingival hypertrophy associated with pregnancy. More recently, Monash[6] also gave this condition a similar name. Blum[7] refers to these proliferations as "pregnancy tumors," and describes them histologically as angiogranulomas, according to Rywkind's classification of epulides. They, at times, attain such large proportions as to interfere with mastication and cause discomfort otherwise. Indeed, I have treated a patient who had three tumor-like masses, sprouting, as it were, one from the other in the "mother, daughter and granddaughter" sequence occasionally described in medical literature (Fig. 10).

The clinical picture of hypertrophic gingivitis of pregnancy varies. The interproximal gingiva may swell to a marked degree, and be forced away from the tooth by subgingival proliferating tissue (Figs. 5-8). This may be a more or less generalized condition, or be especially marked only in the part of the mouth where there is food impaction, traumatic occlusion, lack of function or indeed any other traumatizing agent. At times, the hypertrophied papilla, flattened out in leaf-shaped formation, extends, to a marked degree, occlusally, and spreads laterally toward the central part of the tooth, where it meets a similar extension of the neighboring papilla; the optical illusion of a cleft which might be called a "pseudocleft" resulting. Sometimes, the papillae approach each other so closely and with so much pressure that this pseudocleft is, at first sight, invisible. Therefore, the mass of tissue spreading over the labial surfaces of a

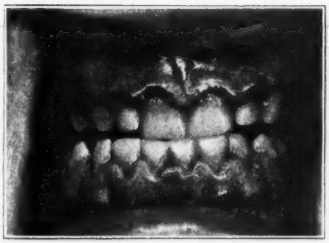

Fig. 15.—Hypertrophic gingivitis brought on by acute Vincent's infection. The entire gingiva was swollen, tender and bled easily. A thin necrotic gingival margin may be seen near the upper incisors. (The other white marks are caused by high lights in photography.)

Fig. 16.—Case shown in Figure 15, after treatment of Vincent's infection.

5. Garretson, J. E.: A System of Oral Surgery, Philadelphia: J. B. Lippincott Co., 1890, p. 672.

6. Monash, Samuel: Proliferative Gingivitis of Pregnancy, D. Items Int., 48:500 (July) 1926.

7. Blum, Theodor: Pregnancy Tumors: Study of Sixteen Cases, J. A. D. A., 18:393-410 (March) 1931.

contiguous row of teeth appears to be continuous. The color may be bluish-pink (cyanotic) at the center of each mass, but it changes to bright red near the edge. This marked inflammatory appearance of the fringed edge of gingival tissue, evidently due to local chemical or bacterial irritation, is fostered by a temporary lack of function or hygiene during that particular period. The patient usually hesitates to use the toothbrush either because of a temporary tendency to gag easily or because of the ease with which gingival hemorrhage is produced in the affected area. As a rule, she does not come to the dentist on account of pain (extreme pain is rarely, if ever, found), but rather because of the easily produced hemorrhage, the unsightly appearance, the inconvenience during mastication or sleep or the fear of malignancy. The hypertrophied masses, if not treated, may continue to increase in size until after parturition, when they usually cease to grow and soon decrease in bulk. Most often, they soon disappear entirely, but, in some instances, continue as small growths. Gingival symptoms closely simulating those of pregnancy may occasionally be found in the mouths of nonpregnant women and in men (Fig. 12).

Fig. 17.—"Primary" or "true" hypertrophic gingivitis. The crowns are partly covered by pink, hard, fibrous masses of gum. Irregularly shaped gingival rugae can be seen opposite the lower bicuspids and molars.

Some operators generally treat cases of pregnancy gingivitis by removing the growths surgically, cauterizing at the point of amputation. I have seen a number of cases in which the growths returned more than once after their removal, sometimes larger than before, within a week or ten days. It is claimed by some that this would not occur if the proper technic were employed. Such reasoning seems justifiable, but in spite of the opinion of many that surgery must be adhered to, I believe that it is contraindicated except in the rare cases in which the pathologic tissue cannot be successfully reduced otherwise, and is particularly annoying. Since proliferation occurs most frequently in the anterior part of the mouths of young women, it is better, certainly, from the esthetic point of view, to avoid unnecessary destruction of the cervical and alveolar gingiva. This is made possible only by

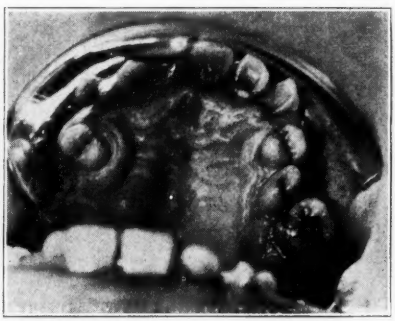

Fig. 18.—Case shown in Figure 17; palatal aspect. Dense hard masses encircle all the posterior teeth; behind the anterior teeth, the gingiva swells beyond the level of the cingula. This is not a painful condition and the patient, about 28 years of age, was not aware of the abnormality until he came for treatment of a Vincent's infection.

conservative treatment, through which, in the large majority of cases, the tissue can be reduced completely or at least to a minimum before parturition. If it should be found necessary afterwards to remove the remaining small mass surgically, that operation would then entail little destruction of adjacent periodontium. In a number of instances in which I had the opportunity of seeing the patient during a succeeding pregnancy, I found that a tendency to recurring hypertrophy was unquestionably kept in check by proper tooth brushing, previously mastered. The only two cases in my experience in which the growths were

Fig. 19.—Case of marked chronic hypertrophic gingivitis in a woman, aged 22. The tissue had previously been twice resected.

unyielding to such procedure had previously been treated surgically and had recurred several days after their removal.

6. Hypertrophy due to an atypical Vincent's infection.[8] This condition presents a picture which, in certain respects, is quite the opposite of the stereotyped form of acute Vincent's infection. Instead of the punched-out appearance of the interproximal gingivae, there is a marked hypertrophy, either of the papillae alone (Figs. 13-14) or of the entire gingivae, which, extending occlusally, at times cover the teeth to a marked degree (Figs. 15-16). In the acute condition, only the crest of the hypertrophied gingiva shows a slight necrotic patch, and the gums feel very tender and bleed easily. In some cases, a chronic hypertrophy may antedate the infection by several years, while, in others, it develops only with the onset of the infection. In these cases, my diagnosis of an atypical Vincent's infection is usually corroborated by the rapid response to treatment, one of the characteristics of that infection. Through this treatment alone, the hypertrophy may be entirely eliminated or reduced to a marked degree. If any hypertrophy persists after the acute symptoms have subsided, it should then be considered a chronic gingivitis and treated accordingly, as above outlined.

The following is an interesting case history of hypertrophy due to atypical subacute Vincent's infection which resisted treatment based on improper diagnosis.

In the case of Mrs. O. L., aged about 30, the hypertrophied papillae between the lower cuspid and lateral incisor on each side of the mouth had been removed surgically before the patient was referred to me by the oral surgeon. (It is of interest to note at this point that because of the abnormal crowding of the lower arch, it had been suggested that, in case my attempt at conservative treatment should prove unsuccessful, the final effort at relief might be the extraction of the lower right first bicuspid to relieve the crowded condition of the arch.) The papillae (Fig. 13) were not tender but quite inflamed, and, in a general way, the condition looked like a chronic hypertrophic gingivitis, which might have been caused by the marked irregularity of the upper and the lower arches as well as by the prognathism. Treatment was inaugurated according to this diagnosis; namely, subgingival curettage and proper tooth brushing. The patient responded quite readily, but

8. Hirschfeld, Isador: Vincent's Infection—Clinical Aspects and Treatment, New York J. Dent., 10:7 (Jan.) 1930.

within a few weeks the original pathologic condition returned. The fact that other papillae, not marked in the original record chart, were now hypertrophied and inflamed, suggested a subacute Vincent's infection, also the possibility that the Vincent organisms had caused the hypertrophy at the very beginning.

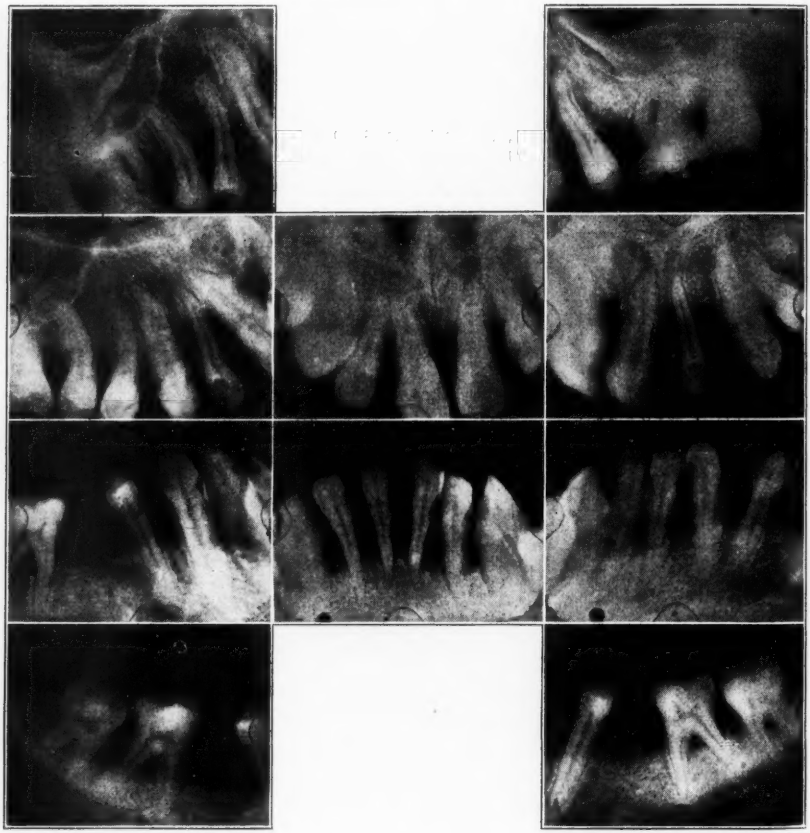

Fig. 20.—Mouth shown in Figure 19. There is extensive absorption of the alveolar process. For obvious reasons, the incisors were extracted before the patient was referred for treatment.

The patient was accordingly treated for Vincent's infection, the treatment including the temporary discontinuance of the brush, and the mouth returned to a healthy appearance (Fig. 14) with the rapidity characteristic of Vincent's infection.

I can reasonably expect that the hypertrophy will not return. It is evident that the surgical as well as the conservative treatment for the chronic hypertrophic gingivitis failed because the diagnosis was incorrect.

7. "Primary" or "true" hypertrophic

gingivitis. This type, found to be congenital, and in some cases familial, is comparatively rare. The condition begins most frequently with the eruption either of the temporary or of the permanent teeth. Both jaws are affected and the hypertrophy is usually bilateral. The tissue is firm, dense and fibrous, is neither painful nor tender and rarely gives rise to hemorrhage. It is pink and, to all appearances, normal except for its massive size. The gums may cover the teeth either partly or so completely that the crowns are invisible. A number of instances are reported in which the hypertrophied gum on either side of the palate reached over toward the median line, producing, on casual observation, the optical illusion of a cleft palate. The progressive enlargement of the gums produces a deformity, such as bulging of the cheeks and lips, separation of the lips and the jaws or protrusion of the gums, which may become very marked and even grotesque. This naturally results in self-consciousness and in the development of an inferiority complex. It is the patient's depression and morbidity rather than

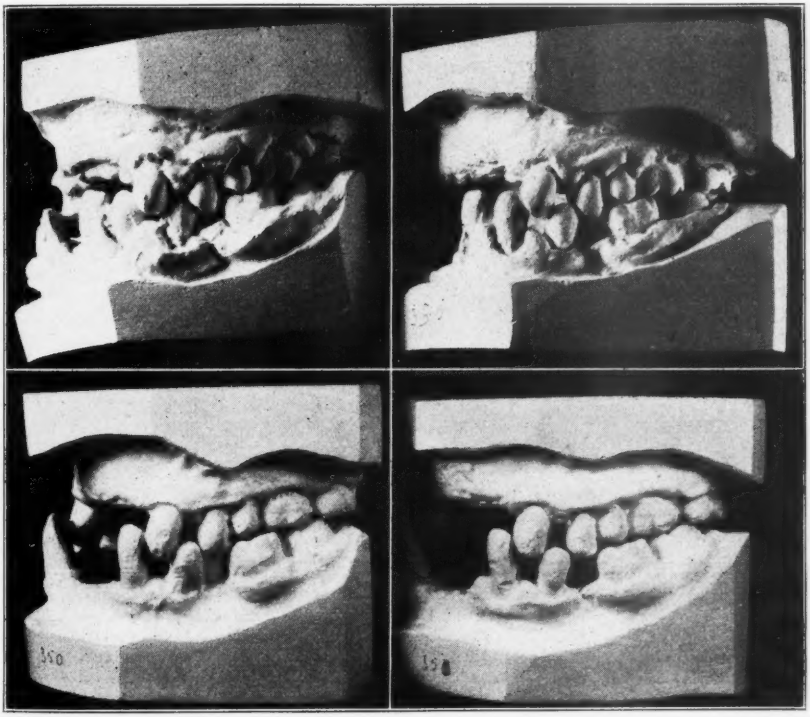

Fig. 21.—Left side of each cast in the progressive series made during the treatment of the patient referred to in Figure 19. Above, left, at beginning of treatment; right, three months later. Below, right, six months and, left, nine months after beginning of treatment.

pain and discomfort that prompt him to visit the dentist for relief from the deformity.

A perusal of reports of these cases reveals that medication in the form of astringents or escharotics is of no avail. The actual or galvanic cautery does not answer, either, since the growths often increase afterward. The excision of the gum only has, in many cases, been followed by a recurrence, as indicated by the fact that most of the cases reported had previously had the gums "pruned." Some report final success with the additional removal of the alveolar border, in which it is believed the growth takes root, and others have found it important to remove the teeth also. The rare incidence of a true or primary hypertrophy is attested by the fact that in the fourteen years that I have been visiting clinics regularly and have been engaged in the special practice of periodontia, I have seen only one such patient, about two years ago. In this case, the condition was only moderately developed (Figs. 17-18). It responded to conservative treatment slowly though definitely, as

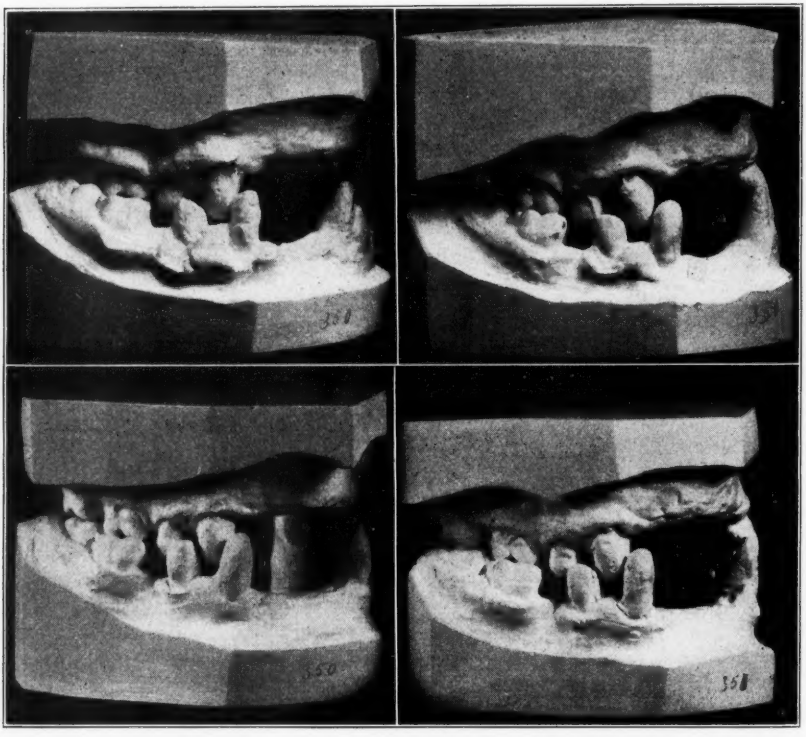

Fig. 22.—Progressive casts, in case shown in Figure 21; right side. Above, left, at beginning of treatment; right, three months later. Below, right, six months and, left, nine months after beginning of treatment.

indicated by serial record casts, but during the interval of a year and a half that the patient discontinued treatment and neglected home care, the hypertrophy returned to the original condition. I feel that, given an opportunity to continue treatment, I could have attained a permanently improved condition.

The following is a report of a case of unusual interest which may well be included in the foregoing category as far as the clinical picture is concerned, even though it was not quite typical.

Miss M. P., aged 21, apparently healthy and well developed, was referred for treatment of a marked generalized hypertrophic gingivitis (Figs. 19-22), by an oral surgeon, after he had extracted all incisor teeth except the lower left lateral tooth. These were, no doubt, of decidedly negative prognosis, as indicated by the roentgenograms.

The hypertrophied gums were massive, and of the consistency of India rubber, and they could be drawn away easily from the teeth with an instrument. They were slightly deeper in color than the normal pink, and did not bleed except when injured by the haphazard use of the toothbrush. The patient could eat comfortably, even though all the teeth were more or less loose, while those anterior to the molars were separated and, like the rest, in marked traumatic occlusion. The gums were detached from at least the cervical quarter of the roots of many of the teeth.

The patient had lived in the Canary Islands since infancy. At 9 years of age, she was severely ill for three weeks, with "gastric fever," soon after which the gums became very swollen. Three years later, they were cut away by a local dentist, and again in Paris, France, when she was 15. In perusing the literature on hypertrophic gingivitis in the course of preparation of this paper, I chanced on an interesting report by the Parisian dentist,[9] which I immediately surmised as referring to the same case. (This belief was verified through correspondence.) His report was as follows:

Patient was examined medically by Dr. Civatte and was found to be normal and in good health. Family history is negative. A biopsy was made by Dr. Civatte of the St. Louis Hospital, who gave an account of the findings, as follows:

"In the cases studied previously the microscopic examination showed only a noticeable hyperacanthosis and a sclerosis of the dermis with small perivascular round-cell infiltration. In our case we found the same hypertrophy of the epidermis, but besides, very different and much more interesting lesions of the dermis. The cell infiltration of the dermis was enormous; there were only a few bundles of connective tissue imbedded in the middle of a dense granuloma consisting, for the most part, of plasma cells. Here and there amongst these plasma cells a giant cell (Langhans' type) was apparent.

"We did not find any Koch's bacilli, but between the cells of the granuloma a few 'round bodies,' ranging in diameter from 5 microns to 15 microns and presenting the forms and tinctorial affinities of the yeast cells.

"The inoculation of the guinea-pig was negative (the animal was killed two months after the inoculation).

"Attempts of culture on Sabouraud's mediums did not succeed either. The Wassermann-Desmoulieres-Hecht reactions ranged from positive to slightly positive."

In this case we attempted treatment, consisting in removing and trimming away with a knife the exuberant gums under local anesthesia in order to free the teeth and give a normal appearance to the region. The wound left by the knife was at once cauterized with chromic acid. The operation was performed in six sittings. The result was, from the esthetic viewpoint, very good. Unfortunately the patient went away without giving us the time to take an impression after the treatment and we are not able to state anything concerning the recurrence as we have not heard from the patient up to now.

The treatment given by me was in accordance with that outlined earlier in the paper, consisting of subgingival curettage and reduction of traumatic occlusion as far as was practically possible, but home care, in the way of frequent proper tooth brushing, was evidently the major factor in the continuous reduction of the

9. Monier, Leon: Gingivitis Hypertrophica —Report of Two Cases, Am. D. Surgeon, 47: 273-274 (May) 1927.

hypertrophic tissue (casts, Figs. 21-22). The curettage was performed twice during the first month, and once every two months during the next eight months, at the end of which time the gums were practically normal in color and contour. During the first month, the hemorrhage accompanying instrumentation was quite marked, but this decreased with the subsequent visits until only accidental traumatization could draw blood. Although smears showed great quantities of both Vincent organisms, little effort was made toward their eradication, except during one period in the middle of treatment when a mouthwash of sodium perborate was prescribed because of a sudden inflammatory appearance, and the gums returned to normal within a few days. Restoration of the missing anterior teeth was then advised with a slight raising of the bite to further minimize traumatic occlusion. The patient has been seen by me every second month for a year since then, and the continued healthy condition seems to promise permanent health, especially because of the excellent home care.

8. Hypertrophy due to scurvy. In this type, the gums are somewhat tender and bleed easily. At first, they are purplish, but, as the disease advances, become blue and then bluish black. The chief etiologic factor is the vitamin C deficiency and the condition improves rapidly through a sufficient intake of food rich in that vitamin. A plentiful use of orange juice is especially stressed. Local treatment is not essential, and at times even contraindicated until the symptoms become less acute.

9. Hypertrophy due to the use of mercury. The gums may become inflamed, swollen and necrotic and be made to bleed easily. There is a history of ingestion of mercury, either through the alimentary tract or through inunction. In both scurvy and mercurial gingivitis, as in pregnancy, the hypertrophy usually focuses about a point of chronic inflammation. The use of mercury is suspended. A mouthwash of sodium chlorid, sodium bicarbonate and sodium perborate, equal parts, is prescribed, and a 5 per cent aqueous solution of chromic acid applied to any ulcerous lesions which may be present. After the acute symptoms subside, the condition is treated as a chronic hypertrophic gingivitis.

10. Hypertrophy due to leukemia. In about 5 per cent of patients suffering from acute lymphatic leukemia, the gums become hypertrophied, sometimes to such an extent that they cover the teeth completely. There is profuse spontaneous bleeding which is usually difficult to control. Needless to say, the gums are comparatively pale. The diagnosis is made through a blood examination. The outstanding clinical point of differential diagnosis is the anemic appearance of the points of the papillae, which, in all other types of hypertrophic gingivitis, are usually of a deeper color than the rest of the tissue. This clinical differentiation prompted me to make a tentative diagnosis of lymphatic leukemia in a case of myelogenous leukemia,[10] and I advised, therefore, an immediate visit to the physician. This gingival condition is included here for differential diagnosis only, in view of the fact that the general condition almost invariably results fatally in a comparatively short time.

It is interesting to discuss the various methods of treatment of hypertrophic gingivitis suggested by writers on the subject. The conservative treatment of

10. Hirschfeld, Isador: Proliferating Hypertrophic Gingivitis: Report of Two Cases Accompanied by Severe Anemia, J. A. D. A. 15:2305 (Dec.) 1928.

chronic hypertrophic gingivitis seems little understood. It is written about even less. The books on oral surgery and oral pathology prescribe more or less uniformly radical procedure; namely, the removal of the gingival tissue, the alveolar border and, at times, the teeth. Some employ caustic drugs; others use the electric cautery. The use of the ultraviolet lamp has been suggested for the reduction of hypertrophy. (I have experimented with this means on a small number of patients and found it ineffective.) Still others excise the swollen portions of the gums freely, and then produce an eschar with the cautery.

I feel convinced that, except in some of the extreme cases of so-called "primary" or "true" hypertrophy, the conservative method of treatment should be the first choice. Although the time required in some instances for the complete elimination of the hypertrophy may be rather lengthy, I have comparatively little difficulty, in most cases, in obtaining a healthy state in a relatively short time and the condition remains normal permanently, especially if the patient employs proper home care. Furthermore, I feel that, as in pyorrhea, the operator who treats hypertrophic gingivitis through radical means is deprived of an opportunity to study and evaluate the approximate influence of the various individual local etiologic factors. The conservative operator, on the other hand, is enabled to observe the pathologic tissues as they progressively return to normal on the removal of the individual causative conditions. Above all, he has the opportunity to acquaint himself with the potency of the toothbrush as a therapeutic means in treatment.

Many instances are recorded in which a second, but more radical operation finally resulted in a permanently normal condition of the gingiva. According to my observations made in postsurgical failures, I am of the opinion that there would probably have been no recurrences in the first place had the diagnosis of the local etiologic conditions been correct and these factors in the case properly eliminated. The reason given by these writers for recurrence after the first operation is failure to remove the underlying pericementum or alveolar border, which remained as a source of infection. To my mind, the probable explanation in many instances for the success of the second operation, which included the removal of a good part of the alveolar process, or even the additional extraction of one or more teeth, is the fact that the gingiva is finally located quite a distance from the incisal or occlusal plane, beyond the range of mechanical traumatization. Also, where either food impaction or extreme occlusal trauma was the chief etiologic factor, it may have been automatically eliminated with the removal of the offending or offended tooth. The correction of these causes would probably have produced the desired result, thus obviating the removal of the teeth. I am convinced of the soundness of this theory, first, by the great percentage of cases of hypertrophic gingivitis that I have treated successfully without any surgical procedure at all, and, secondly, by the fact that in most instances of postsurgical failure which had been referred to me, it was still possible by conservative treatment alone to return the gingival tissue to a permanently healthy status.

As mentioned earlier, the esthetic angle, especially in younger patients, is also a very important consideration in selecting the conservative method of treatment. Moreover, the exposure of the root surfaces, which must follow whenever the alveolar border has been

removed, entails an unhygienic condition, which, in turn, renders them sensitive and subject to erosion and caries. An important consideration also is the fact that, since the patient realizes that the cure has been attained essentially through the proper use of the toothbrush, he is inclined to continue the brushing quite conscientiously, with the result that the possibility of a recurrence of the original pathologic condition is remote.

SUMMARY

1. The etiology, symptomatology and treatment of hypertrophic gingivitis are greatly diversified. In some instances, the gingival hypertrophy is essentially a symptom of a systemic derangement; in others, it is caused by local irritants which may be especially effective in the presence of a predisposing systemic condition.

2. The overlapping of adjacent anterior teeth predisposes the patient to interproximal hypertrophic gingivitis.

3. An atypical Vincent's infection, acute or subacute, may cause a hypertrophic gingivitis which simulates a chronic condition. Therefore, it is a good policy to institute invariably a course of treatment of the Vincent's infection as a preliminary step in treatment of all forms of hypertrophic gingivitis.

4. In the conservative treatment of chronic hypertrophic gingivitis, frequent nontraumatizing subgingival curettage aimed at "blood-letting" is a potent means of rapidly reducing the inflammation and bulk of the gingiva. The remaining hypertrophy may then be further reduced by the conscientious use of the toothbrush.

5. As brushing is quite effective also in preventing a recurrence of the condition after the completion of treatment, the patient must be thoroughly impressed with its importance.

6. When a second but more radical operation succeeds in permanently eliminating chronic gingival hypertrophy, it is quite probable that, in many instances, the improvement is due to the ultimate extension of the gingival crest beyond the reach of traumatizing agencies. Had the diagnosis of the causative factors in the condition been made correctly, and the traumatizing agents been removed instead, surgery might have been dispensed with, to the advantage of the patient.

7. In the treatment of several cases of hypertrophic gingivitis in which the ultraviolet lamp was used for experimental purposes, the results were not encouraging. Medication is similarly ineffective.

8. Surgical procedure should be used only as a last resort in the large majority of cases of hypertrophic gingivitis, since many disadvantages may follow in its wake; namely, unesthetic appearance, hypersensitiveness, erosion, caries and the probability of a recurrence of the hypertrophy. As these are avoided through conservative treatment, that, logically, should be the preferred method.

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HISTOPATHOLOGIC STUDIES OF THE SUPERFICIAL PERIODONTAL TISSUES*

By W. M. REPPETO, D.D.S., Dallas, Texas

KNOWLEDGE of the pathologic processes taking place in the tissues of the oral cavity has increased so rapidly in the past few years that the information gained has as yet not been correlated to the extent that the knowledge of general pathologic lesions has. Dental pathologists have had an advantage that the early pathologists in medicine did not have in that the principles of physiology are more common knowledge even to the dentist than they were to the early investigators in the clinical and microscopic study of disease processes in tissue. The study of functional activity of cells, tissues and organs has enhanced our knowledge of pathology or abortive physiology greatly. There is now a tendency to consider pathologic changes as physiologic attempts to remedy injuries suffered by living tissue due to such conditions as trauma, chemical and physical states, hereditary abnormalities, neoplastic aberrations of cells and tissues and bacterial infection.

Nature's protective force, inflammation, has as its purpose the combating of the effects of such abnormal stresses on living tissue, and if the balance of power rests in this physiologic process, resolution of the lesion results. Even though this happy result culminates the process, the tissues in the area affected are never in the same state of health as they previously were. Resolving processes may result in tissue changes which preclude normal function and metabolism. The replacement of specialized and differentiated tissue by dense fibrous healing tissue, while the process results in at least an arrestment of the progress of the disease present, is only a compromise. The biologic facts are that tissues are not able continuously to stand undue stresses and that cellular degeneration eventually results, with death of tissues, organs and the body as a whole culminating the struggle our bodies wage against destructive agents.

Many of our recent research problems have dealt with the embryology and physiology of the oral tissues. Many questions and points are as yet unsettled, and it appears that too much time is spent in "hair-splitting" concerning intimate details of the problems, which cannot add much to the knowledge necessary to the dental profession to diagnose and treat successfully the diseases within our field. Various so-called schools with their proponents and opponents have waged war on one another, seemingly losing sight of the ultimate goal which should be reached, resulting in the dissemination of practical knowledge. The field of study of the microscopic changes in

*From the Department of Oral Pathology, Baylor Dental College.

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disease of the more superficial periodontal tissues has caused much argument and discussion, but the time seems to have arrived when we must consider the oral tissues as an anatomic region of the body reacting basicly in the same manner as do the tissues of any of those other regions. The finer points of histopathologic research are of such little practical value to the general practitioners of dentistry that the average dentist quickly turns over the pages in his reference texts and scientific journals which present photomicrographs. His school training has left him woefully deficient in basic knowledge to understand and interpret the microscopic reactions of tissues under specific conditions.

Fig. 1.—Topographic relationship of periodontal tissues.

The purpose of this paper is to present some of the more ordinary pathologic lesions which are not purely diseased areas, but areas in which physiologic attempts at resolution have resulted in microscopic pictures which are quite different from the ideal histologic conceptions of what such tissues should look like in a perfect state of health. Tissues subjected to mechanical and physical abuses such as those encountered in the oral cavity very rarely show ideal conditions present, but we do have a normal or average state of affairs on the basis of which to judge the seriousness of those findings which are met with.

The identification of the epithelial attachment by Gottlieb, Orban and others was one of the greatest forward steps in the furthering of comprehensive knowledge concerning the state of affairs which exists in the periodontium at certain ages

and under various conditions. The process of the formation and growth of this structure has been and still is a subject of great controversy. Careful observation seems to point to the fact that most of the workers are correct in a great many of their ideas and interpretations, but different technics of tissue preparation and different specimens have presented

cence of the various cellular layers of the enamel organ, and remnants of them, with the epithelium of the oral mucous membrane forming a definite and strong attachment between the enamel of the tooth and gingival tissues in the earlier stages of eruption and between the cementum and the gum as the process of eruption advances. The epithelial attach-

Fig. 2.—Intact epithelial attachment, inflammatory cellular infiltration and heavy supra-alveolar fibers.

so many various pictures that these men have been inclined to minimize the importance of the work and results of the man who reports findings that appear superficially to be contradictory. Let us grant then that there is an epithelial attachment which results from the coales-

ment without question grows apically, as the study of only relatively few specimens showing the tooth and its supporting structures will evidence. The process does not appear to be purely pathologic as one group suggests, nor it is entirely physiologic as another group contends,

but probably occupies a field between the two. The apical growth of this attachment does not seem to be the same on all teeth nor on all surfaces of any one tooth, at any specific time. Various features peculiar to a certain tooth or group of teeth or the body as a whole contribute to the different pictures presented. This structure protects the deeper portions of

Fig. 3.—Topographic view of periodontal structures.

periodontium from external forces to a great extent, and owing to the fact that its position associates its study with the study of the gingival tissues, and supra-alveolar connective tissue as well as the enamel cementum and alveolar crest, pictures of tissue reactions of those of these tissues wherein it is possible to evidence them have been selected.

Figure 1 shows the interproximal tissues in what might be called an average or normal condition in an adult. The epithelium shows some hyperplasia in the superficial areas of the gingiva, but there is no extreme reaction present. The most apical portion of the epithelial attachment is at the cemento-enamel junction, protecting the underlying tissues from invasion, practically speaking. The alveolar crest under higher power shows some changes which might be construed as being of importance, but they are rather minimal. Figure 2, a higher magnification, shows the epithelial attachment to be intact, the small break in the attachment to the cementum being an artefact. Dense bands of supra-alveolar connective tissue are clearly evident. There is relatively little cellular infiltration.

Figure 3 shows an epithelial attachment which has grown apically, being in contact with the cementum over a wider expanse of area than that shown in Figures 1 and 2. Figure 4 is a higher magnification of the attachment, showing that it is quite intact. The connective tissue adjacent to it shows some cellular infiltration, but it is relatively slight.

Figure 5 shows an epithelial attachment which is undergoing slight lateral proliferation, but the reaction cannot be construed as being of major importance. The connective tissue beneath the attachment presents practically no evidence of inflammation. The superficial gingival tissues present quite a little evidence of inflammation, but the periodontal process is still limited in these areas.

Figure 6 shows marked epithelial proliferation and connective tissue hyperplasia and infiltration, but the epithelial attachment is well within normal limits in its apical growth and is still function-

ing as a barrier to protect the deeper structures from direct invasion of organisms and the action of food débris.

Figure 7 is an example of extreme inflammation progressing to a degree of ulceration in the gingiva; epithelial proliferation and hyperplasia and cellular infiltration of the connective tissue being very pronounced. The epithelial attachment remains intact, having merely undergone a more pronounced apical growth than those shown in the preceding illustrations.

Figure 8 shows two different types of epithelial attachment on two adjoining teeth. That on the right is quite normal, while the attachment on the left is beginning to degenerate and is losing its barrier function. The evidences of widespread inflammatory changes are marked.

Figure 9 shows an epithelial attachment which has degenerated to the point that it is no longer a structure which can fulfil its functions. The epithelial cells have lost their structure, and there is cellular infiltration in the epithelial tissue. Epithelial tissue is quite resistant to cellular infiltration, and the process does not usually take place until far advanced degenerative changes have been instituted. The cementum shows hyperplastic and degenerative changes which have been brought about probably as a physiologic attempt to inhibit further progress

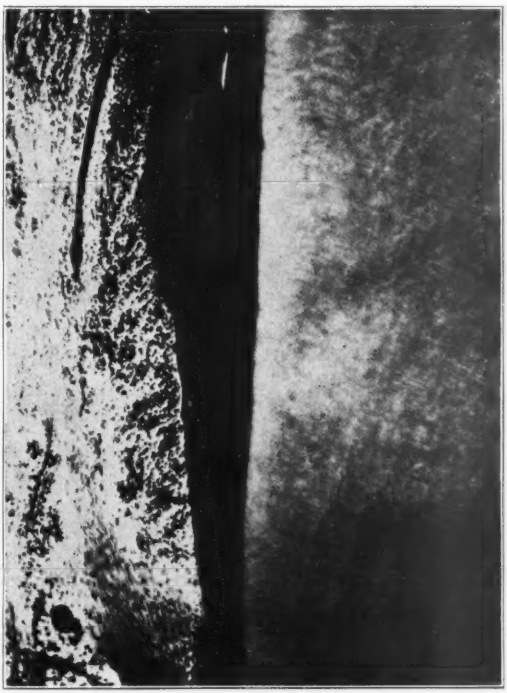

Fig. 4.—Higher magnification of Figure 3, showing epithelial attachment to be intact.

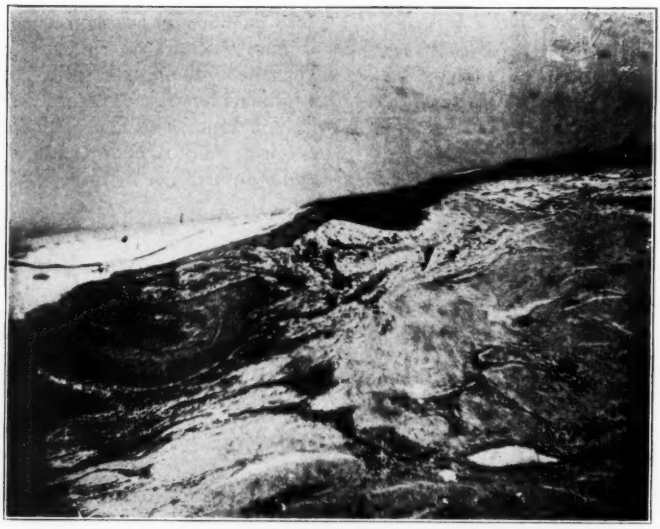

Fig. 6.—Intact epithelial attachment on cementum.

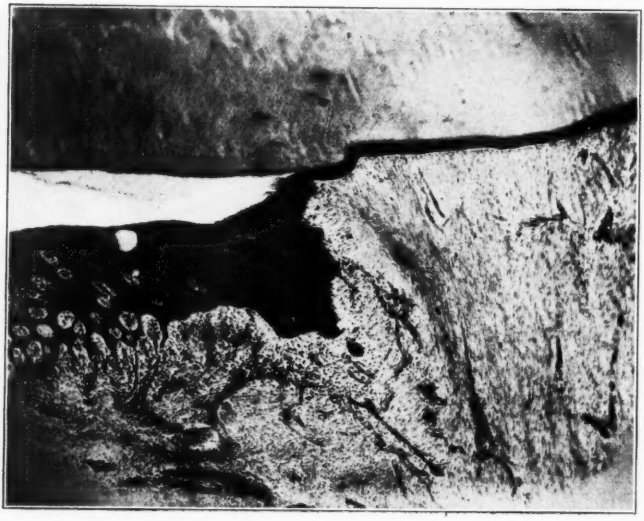

Fig. 5.—Intact epithelial attachment, showing some lateral growth; subepithelial inflammation.

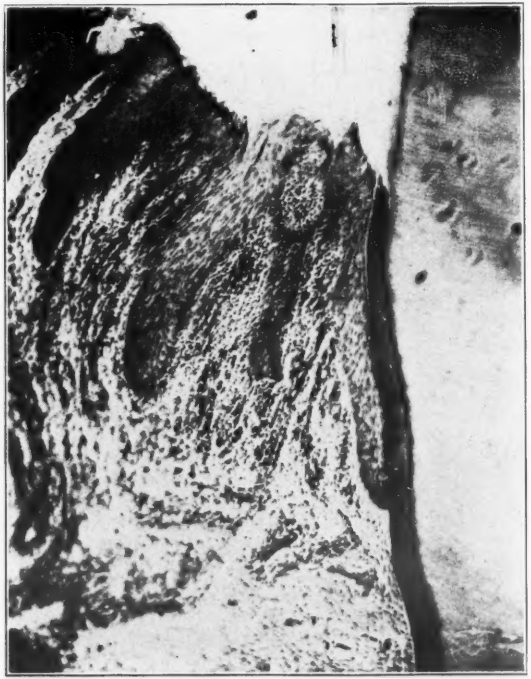

Fig. 7.—Extreme gingival inflammation with epithelial attachment intact on cementum.

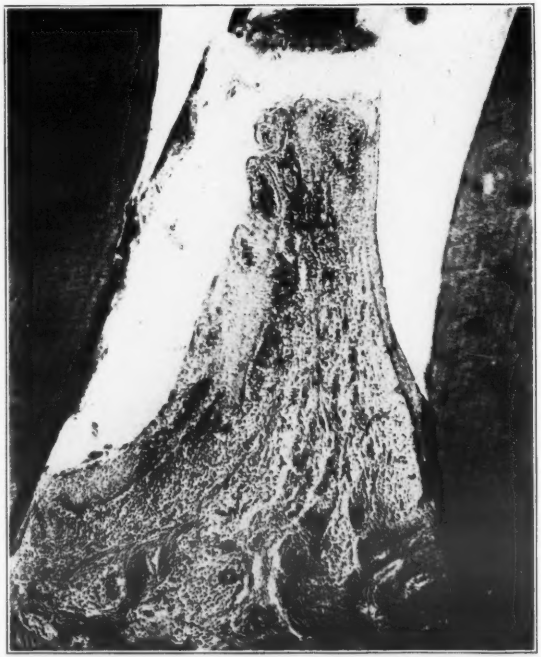

Fig. 8.—Different levels and contours of two epithelial attachments between two molars.

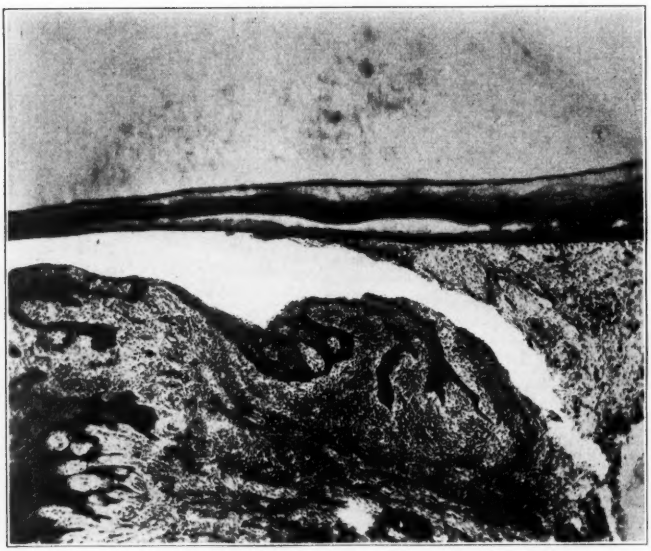

Fig. 10.—Heavy infiltration of gingival tissue with break in epithelial attachment.

Fig. 9.—Epithelial attachment which has undergone degenerative changes; extreme cemental reaction.

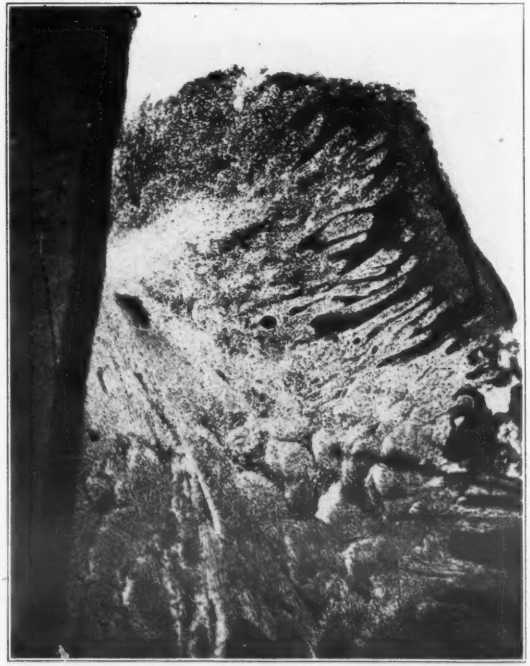

Fig. 11.—Gingival inflammation with loss of crest epithelium and epithelial attachment.

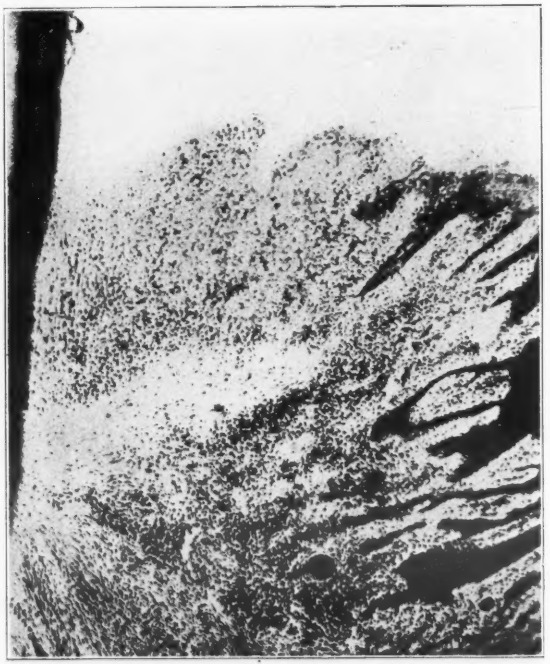

Fig. 12.—Higher magnification of Figure 11, showing complete destruction of epithelial attachment.

Fig. 14.—Higher magnification of Figure 13, showing epithelial reaction to food impaction as well as cellular infiltration and hyperemia of subepithelial connective tissue.

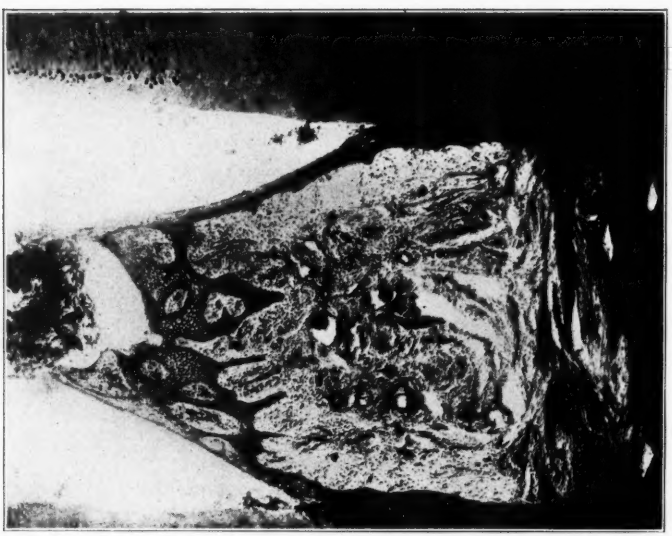

Fig. 13.—Topographic view showing effects on superficial periodontal tissues of food impaction.

of the periodontal disease, which is unquestionably advancing rapidly. This reaction in the cementum may be a purely pathologic condition. Cemental reactions are sometimes difficult to classify as to whether they are physiologic or pathologic or a combination of the two possibilities. The connective tissues show extreme cellular infiltration and degeneration indicating a marked inflammatory and pathologic reaction. The protective structures of the periodontium have broken down to such a degree that rapid extension of disease would be considered extremely probable in such a condition if proper treatment were not instituted.

Figure 10 is of an epithelial attachment and its surrounding tissues in which the inflammatory process present has caused a complete malarrangement of the tissues. The epithelial attachment has lost its attachment faculties and has taken on the appearance of hyperplastic inflammatory epithelium with no particular function. Epithelium, under these circumstances, still has some protective function, but its major function is that of retaining the so-called "tissue balance" which usually exists in inflammatory reactions. The connective tissue is also hyperplastic owing to the inflammation, and the epithelium has kept pace with

Fig. 15.—Topographic view of periodontal structures and their reaction to calcular irritation.

this hyperplasia. Malignancy results when tissue balance is lost, and it may be due to the fact that the epithelium of the oral cavity possesses such hyperplastic faculties to balance the connective tissue overgrowth and vice versa that malignancies are relatively rare in the oral cavity. There are, of course, many malignant neoplasms found in the oral cavity, but when we consider the traumatic influences which react on the affected tissues, it is surprising that more carcinomas and sarcomas do not occur. It is questionable that there ever is a reattachment of the epithelium to the tooth after the treatment of such a case. The probabilities are that there is only a fibrosis which causes the gingival tissue to approximate the tooth more closely after the inflammatory process has subsided.

Figure 11 shows complete destruction of the epithelial attachment, its place having been taken by a mass of inflamed connective tissue which is infiltrated with inflammatory cells to the same degree that granulation tissue is. Were it not for the fact that the number of blood vessels is most minimal, this might well be called granulation tissue. The epithelium present has undergone a relatively great degree of inflammatory hyperplasia and there is dense fibrosis present below the subepithelial tissue to hinder the progress of the lesion in depth.

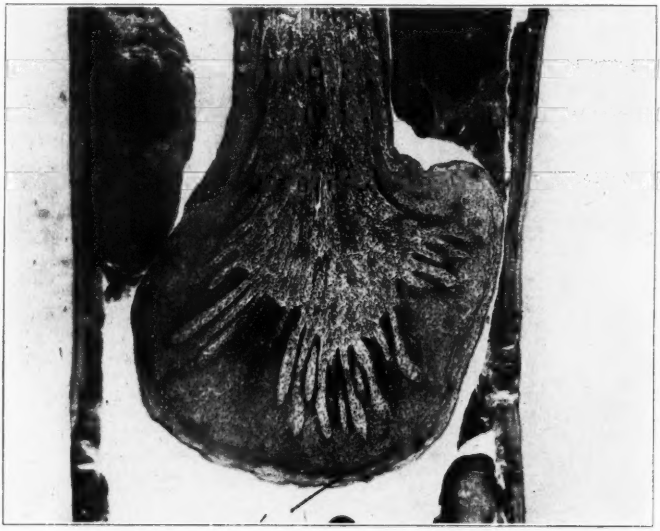

Fig. 16.—Higher magnification of Figure 15, showing more details of effects of calcular irritation.

Figure 12 is a higher power of Figure 11, showing the loss of the epithelial attachment and the heavy cellular infiltration. This is the type of lesion which might well result from a poorly contoured and ill-fitting filling.

The preceding photomicrographs (Figs. 1-12) have shown some of the changes which may take place in the epithelial attachment during life, and it

is surely of importance that this structure be spared as much traumatic influence as possible, which can be assured by scientific operative and prophylactic procedures. The following illustrations (Figs. 12-20) evidence some of the pathologic changes in the gingival tissues in diseases affecting the periodontal structures. The gingival tissues are composed of connective tissues and epithelium primarily, both tissues having the ability to become hyperplastic and inflamed in order to localize periodontal lesions for varying lengths of time. Such ability is limited and the deeper structures of the

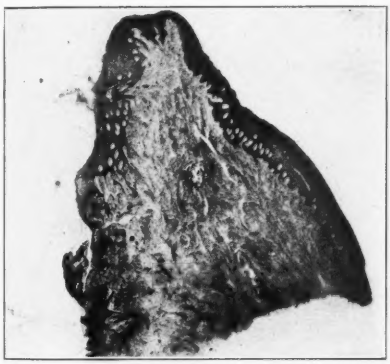

Fig. 17.—Gum papilla showing ulcerative process on buccal surface.

periodontium are bound to become involved sooner or later.

Figure 13 shows the relationship of the superficial periodontal tissues in a case in which there is undoubtedly food impaction. The epithelium, encroached on by material which is probably food, is actively resisting the effects of the trauma. The connective tissue becomes heavily infiltrated and somewhat hyperplastic in its effort to bear part of the burden. The epithelial attachments of the adjoining teeth are performing their function as a barrier and the supra-alveolar tissue is very dense, it having undergone some fibrosis to farther protect the deep structures. Figure 14 shows a higher magnification of the crest tissues. The epithelial tissue has conformed itself according to the trauma exerted on it by the impaction of food. The cells at this magnification appear to be relatively normal from a qualitative standpoint over a wide area. The subepithelial connective tissue is highly infiltrated and greatly affected by the reaction which has taken place. Some of the superficial epithelial cells have degenerated to almost complete necrosis. If such a condition is allowed to remain uncorrected for an indefinite period of time, the time varying according to the local and general resistive powers of the patient, the periodontium becomes affected to the point that there will be a serious breakdown in its function of supporting the teeth. Improper contacts result in this type of picture.

Figure 15 is of an interproximal area in which there has been a serious reaction due to the irritating influence of calcular deposits. The superficial portion of the gingival tissue is hyperplastic. The reaction has been so extreme that there is only a microscopic opening from the most superficial surface of the calculus to the exterior. Extensive hyperplasia of the epithelium and hyperplasia and cellular infiltration of the connective tissue are evident at this low magnification. The deeper structures of the periodontium, such as the supra-alveolar tissue, alveolar crest and periodontal membrane, have undergone marked changes. Owing to the swelling and hyperplasia of the gingival tissue, there is a great variance from the normal in the distance from alveolar crest to gingival crest; a point of major importance.

Figure 16 is a higher magnification of

the gingival crest showing the marked and consistent hyperplasia of the epithelial tissue and the bands of fibrosis and strands of cellular infiltration in the connective tissue. As in most reactions of this type in the gingival tissues the infiltrating cells are lymphocytes, leukocytes and plasma cells. The calculus is clearly evident and its presence explains why gingival tissue will undergo hyperplasia when such an irritating influence is present. The cementum has undergone no apparent reaction in the presence of the extreme inflammatory reaction of the adjacent tissues. Clinically, this type of case presents the signs with which most dentists are familiar: hyperemia, hemorrhage and swelling of the gums.

Figure 17 is a photomicrograph of a more chronic type of gingival disease. The epithelium is rather consistently hyperplastic with an ulcerative process present on the buccal surface. This is a gum papilla which was removed during a surgical extraction. The connective tissue is densely fibrous and heavily infiltrated. The wild growth of the epithelium is evident even at this low magnification. Figure 18 is a higher magnification of the ulcer, showing quite an uncontrolled epithelial growth in the form of penetrating strands and isolated nodules of various shapes. A higher magnification of these nodules shows that there is a tendency to pearl formation in some of them. Figure 19 is a higher magnification from the ulcerative area showing the degeneration of the external epithelial cells and one area in which there is almost a complete opening to the connective tissue from the exterior. The large space probably was filled with blood or at least lymph, as all these reactions shown have some edema present, and such a space is

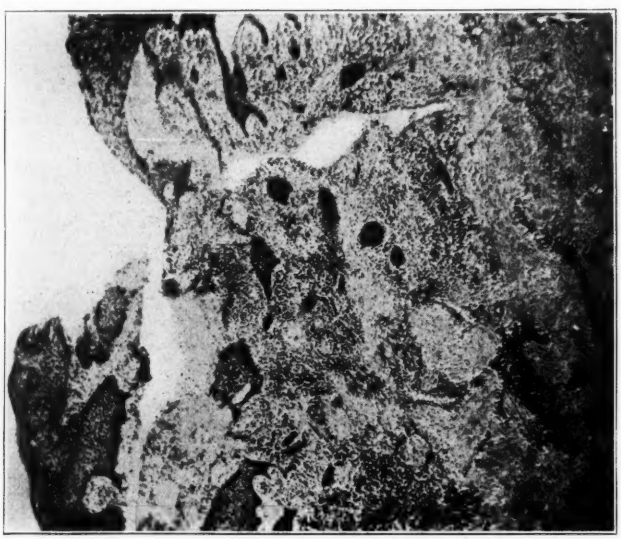

Fig. 18.—Higher magnification of Figure 17, showing wild growth of epithelium in ulcerated area. The connective tissue reaction is quite pronounced.

similar to those found in the development of the so-called epulis. The isolated epithelial nodule shows the early stages of pearl formation. The reaction in the epithelium is so marked in this picture that it borders on the malignant in appearance, but it is not malignant. Figure 20, from the peak of a crest, exhibits a very extensive hyperplasia of epithelium and heavy cellular infiltration of the connective tissue. Such a piece of tissue presents most of the microscopic classic signs of subacute or border-line chronic pathologic changes.

Fig. 19.—Gingival crest region showing hyperplasia and degeneration of epithelium and isolated epithelial nodule undergoing "pearl" formation.

These photomicrographs have been presented to add some contribution to the general knowledge of the microscopic reactions of the more superficial tissues of the periodontium in the presence of some of the every-day stresses with which they are burdened. At least some knowledge of these reactions is necessary to guide the dental profession in the care, diagnosis and treatment of the tissues which can be and are directly influenced by the more ordinary operative and prophylactic procedures of every-day practice. The practitioner of medicine has made practical use of the knowledge of micropathology, and the practical vision of every dentist can be greatly broadened by the utilization of the fundamental principles of tis-

sue pathology as evidenced under the microscope in connection with those clinical observations which his eye is supposed to be trained to appreciate and analyze.

DISCUSSION

Ralph R. Byrnes, Atlanta, Ga.: I agree with Dr. Reppeto that a dentist should know something of the microscopic anatomy of the tissues of the oral cavity. It is most important that he know the underlying reasons for such conditions as bleeding gums and swollen tissues. He should be able to visualize just what is happening to the cells of a tissue presenting such symptoms. Having such microscopic knowledge, he will be in position to treat such tissues intelligently. Any treatment accorded a tissue or tissues must necessarily be directed at the individual cells, as they are the physical, physiologic and structural units of tissues. One would not expect a physician to be able to treat the stomach intelligently were he devoid of a comprehension of its cellular structure. There is an analogous situation in the case of the dentist. A dental practitioner can hardly treat oral tissues intelligently without a knowledge of those tissues in the normal and pathologic states. A correlation of the facts of histology, pathology and physiology would save many a dentist from blindly applying doubtful treatments and resorting to questionable operative procedures. Dr. Reppeto's photomicrographs leave a definite impression that the oral tissues are particularly susceptible to infections stimulated by environmental conditions favorable to the proliferation of mouth bacteria in the periodontal tissues. He shows how such mechanical conditions as the presence of faulty fillings, mal-

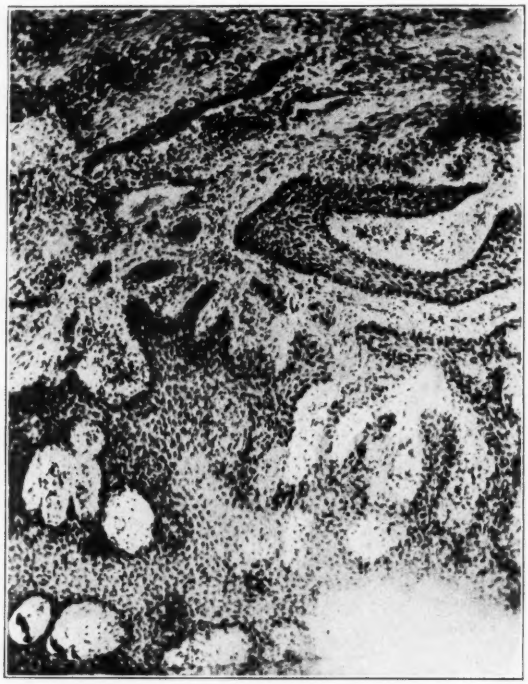

Fig. 20.—Gingival crest region showing epithelial and connective tissue reactions to superficial periodontal lesion.

posed teeth, food packs and calculus can weaken the overlying protective, epithelium and lower its resistance to invading bacteria. Now that we can visualize what is taking place in the cells under such circumstances, we can realize more vividly the importance of eliminating by operative work and treatment conditions such as these which contribute to the lowered vitality of the oral tissues. We can see what a tremendously important thing a proper contact point is. Dentists have regarded such facts too lightly in the past because of an inadequate knowledge of just such things as have been shown by Dr. Reppeto in his interesting illustrations. In his discussion of Figure 16, Dr. Reppeto gives a picture of hyperplasia of the epithelial cells due to calculus. While it is apparent that the epithelium in that illustration is thicker than normal, I am not quite satisfied in my own mind whether in Figure 17, the outlaw growth of epithelial cells of which he speaks is in reality such. If I recall my normal histology correctly, the epithelium lining the oral cavity rests upon a basement membrane which dips down into the subjacent connective tissue to form secondary papillae. As the finger-like invaginations of the epithelium do not always pursue a straight course, I should like to know whether it is not possible that the microtome knife could cut through these papillae in such a way that the nests of epithelial cells in the connective tissue, which appear to be detached from the overlying epithelium, are in reality not detached, but are continuations of the overlying epithelium curved back on itself. When an outlaw growth of epithelial cells occurs in connective tissue, there is usually some break in the basement membrane. I do not believe that I observed any such break in the photomicrograph except that caused by the mechanical factor of ulceration. (Figs. 17-18.) I should like to know also whether a certain amount of lymphoid cell infiltration may not be normal in practically all stratified squamous epithelial tissues. I recall that a microscopic section of the tonsil, for instance, shows a heavy infiltration of lymphoid cells in the overlying epithelium, as well as in the subjacent connective tissue, where the cells form lymph nodules. I believe such infiltration of lymphoid cells in the tonsillar epithelium is considered normal. If I am wrong in this, I would like to be corrected. Dentistry needs more experimental microscopic work of this character. If they are to make any real progress in the treatment of oral lesions, dental practitioners will be compelled to give more attention to the microscopic pictures of the tissues they treat.

Dr. Reppeto: Regarding Dr. Byrnes' observations concerning the epithelial reactions as evidenced in Figures 17 and 18, I wish to say that the small nodules of epithelium in the connective tissue area were checked up in approximately fifty sections of this tissue and there was no evidence that they were definitely attached to the other epithelium. It may be that I used the word "outlaw" concerning the epithelial growth indiscreetly, as the hyperplasia and misplacement of the epithelial structures unquestionably were attempts to reepithelialize the area of ulceration. The appearance in Figure 18 is surely that of an epithelial involvement which is not within normal limits quantitatively or topographically. Infiltration of inflammatory cells is not a normal condition in the epithelium of the tonsils. There unquestionably is a physiologic infiltration of lymphocytes in the gingival tissues, but I feel that those areas defined as being pathologic in the paper were not within the bounds of a clear-cut physiologic reaction. I am indebted to Dr. Orban for the use of some of the tissues shown.

THE RELATION OF DENTAL INFECTIONS TO SOME SYSTEMIC DISEASES*

By LYLE MOTLEY, M.D., F.A.C.P., Memphis, Tenn.

THE idea of focal infection as the cause of disease is not entirely new, since writings have been discovered saying that an ancient Egyptian king was told that he would not get relief of the pains in his feet and back, unless he had his teeth extracted. The first systematic study of the rôle of focal infection in the production of disease, with an attempt at rationalization of that rôle was made in this country early in the twentieth century, and there is little doubt that a valuable contribution to the cure of disease was brought to our attention by the pioneer workers in this field.

There soon followed a wave of enthusiasm paralleling that which always accompanies a new idea in medicine, with the usual abuses and resulting evils. Discredit was reflected on a valuable new principle, as a reaction both on the part of the skeptic and on the part of the enthusiast himself, who was disappointed by the lack of results from ill-advised removal of teeth and tonsils. The Europeans, and particularly the Germans, were slow in accepting the idea of focal infection, and there is considerable reluctance among European writers at the present to accept the idea as it is taught in this country.

The pendulum of opinion for and against focal infection, "which has swung with considerable noise and vibration during the past few years," appears to be assuming a more reasonable and conservative position, where the true value of the focal infection theory is appreciated, and the elimination of infective foci is undertaken because there are proper and rational indications for the procedure. There is still much abuse of the measure, valuable teeth being needlessly sacrificed, even at the present time. Among the most important sources of infection in systemic disease are the teeth and their adjacent structures. Because of their accessibility for study, the teeth have probably received more interest in connection with the problem than have any other tissues, and unfortunately this very accessibility, together with their relative ease of removal, has caused much bad practice on the part of both the medical and the dental profession.

Among the conditions and diseases which have been variously attributed to dental infection may be mentioned almost all chronic degenerative and inflammatory conditions. The most attention has been given to arthritis, peptic ulcer, neuritis and inflammation of the various structures of the eye. Nephritis, colitis, encephalitis, functional nervous and mental disturbances, asthma, bronchitis, the various dermatoses, endocrine disturbances, including diabetes, and many other conditions have come in for their share of attention in connection with dental infection.

*Read before the American Society of Oral Surgeons and Exodontists, Memphis, Tenn., Oct. 16, 1931.

A review of the literature shows a sharp division of opinion regarding the rôle of focal infection in systemic disease. There are those who bring forward clinical and experimental evidence that the focal infection itself is the chief cause of the disease conditions which are attributed to them. This school has strongly championed the idea of elective localization of bacteria in different tissues and has supported its contention by voluminous reports of experimental work on animals. There are those who would have us believe that the association of focal infection with systemic disease is incidental, the former playing little part in the actual production of the latter. The majority of the medical and dental professions are agreed that infection in and around the teeth can and does cause disease.

Before discussing the theories regarding focal infection, let us consider the nature of dental foci of infection, which are the type immediately interesting us. A dental focus of infection may be described as a circumscribed infected area within the alveolar process which does not have drainage other than through the blood and the lymph stream.[1]

These infections may occur in any part of the tooth structure and its contiguous tissues. The rôle of caries is questionable except when the destruction extends deeply enough to reach the pulp canal, where absorption by the blood stream can take place. The same situation applies to pyorrhea, as in a simple gingivitis there is too free drainage to the surface to allow absorption. Of the two processes, the closed infection is considered more harmful than alveolar absorption.[2] When the infection extends deeply enough to cause a considerable degree of alveolar destruction, the process ceases to be an open one and there is a probability that absorption may occur. I believe that Vincent's infection can be disregarded as a source of systemic disease. Vincent's organisms, which are saprophytic, i. e., will grow only on diseased tissue, are normally present in practically all dentulous mouths, whether healthy or not. Systemic invasion of these organisms during life is unknown, and the disease plays no part in chronic conditions attributable to focal infection.

There is much discussion in the literature as to what kind of tooth may be said to be infected. For various reasons, it is impossible at times to say positively whether a tooth is or is not infected, and at times a most careful examination of the tooth in question will give us no positive information. Reliance is most often placed on roentgenography, but it is obviously impossible to translate the presence or absence of periapical bone changes into terms of presence or virulence of bacteria. The familiar periapical area of radiolucence or "abscess" is no guide, as such teeth are shown not infrequently to be sterile on culture. Such areas of bone absorption can be caused by the presence of irritating drugs used in sterilizing the root canal. Price,[3] who considers that the granuloma occupying this periapical area is a defense mechanism, has shown that bacterial growth in the presence of this granulomatous tissue is inhibited.[3]

Price also considers periapical bone absorption as an indication of a local

1. Cook, T. J.: D. Cosmos, 71:711 (July) 1929.

2. Hubeny, M. J.: Am. D. Surgeon, 50:174 (April) 1930.

3. Price, W. A.: Dental Infections Oral and Systemic, Cleveland: Penton Publishing Co., 1923.

defense process preventing systemic invasion of organisms. On the other hand, Bulleid studied bacteriologically eighty specimens of granulomas, which had been removed from the teeth, and in every case a member of the streptococcus group was recovered. Haden[5] found by cultural methods nearly as high a percentage of infection in pulpless teeth roentgenographically negative as in pulpless teeth that were positive.

It therefore appears obvious that we have no accurate method of determining whether a given tooth is the site of an infection from disease-producing bacteria and must content ourselves with saying that a tooth is potentially infected. It would seem that this opinion must be based finally upon the demonstration of the devitalized state of the tooth. I believe that unerupted impacted teeth, for practical purposes, should always be considered as a potential focus of systemic infection. A final and positive diagnosis rests upon the removal of a suspicious tooth with special precautions and its study by bacteriologic methods.

Demonstration of infection in the tooth alone is not always final proof of its connection with a systemic disease, as in the case quoted by Gerstly[6] in which *Streptococcus viridans* was cultured in large numbers from a pulpless tooth in a patient who had a *Streptococcus viridans* endocarditis. Serologic tests and sugar fermentation studies showed the organism recovered from the tooth to be a totally different strain from the one which was causing the disease in the patient.

The bacteria principally concerned in infections of the teeth are those of the streptococcus group. The classification of the streptococci is in a confused state, owing to the existence of individual opinions, of different workers, but the two most important strains are the well known *Streptococcus hemolyticus* and *Streptococcus viridans,* both of them being notoriously pathogenic.

The chief evidence supporting the causative rôle of dental infection in systemic disease is clinical. Much of the experimental work on animals, particularly Rosenow's and Haden's studies, is open to criticism from several standpoints, for the reasons, among others, that large doses of cultures were used and directly injected into the blood stream, and micro-organisms were employed at the height of virulence, coupled with the fact that other investigators are unable to agree on the interpretation of the findings of these two workers. A table submitted by Rosenow[7] would seem to show that the injected animals develop a septicemia rather than any elective localization of specific nature. For instance, the experiment on herpes zoster, carried out in sixteen animals, showed a localization in twenty of the twenty-nine organs.

Haden's[5] results are open to the same criticism. The injection of 5 c.c. of a bacterial culture into a rabbit would equal something less than one-half pint of the same culture in the average adult, and I believe that after such an injection something is obliged to happen, regardless of the specific localizing properties of the organisms. There is also considerable difference between the rapid injection of an overwhelming dose of bacteria intravenously and the slow ab-

4. Bulleid, Arthur: Guy's Hosp. Rep., 81:116 (Jan.) 1931.

5. Haden, Russell: Dental Infection and Systemic Disease, Philadelphia: Lea & Febiger, 1928.

6. Gerstly, J. R.: M. Clin. N. America, 14:1221 (March) 1931.

7. Rosenow, E. C.: J. D. Res., 1:205 (Sept.) 1919.

sorption of bacteria or their products from a small area of infection in a tooth.

Further conclusions drawn from lesions found in animals after the injection of streptococci from foci of infection may be erroneous for other well established reasons. The question of experimental production of peptic ulcer in animals, for instance, is confused by the fact that certain laboratory animals are prone to develop these conditions under experimental environment. Rosenau and Anderson[8] found lesions of the stomach in 66 per cent of 2,282 guinea-pigs dying soon after injections of diphtheria toxin. Carlson[9] reported that 75 per cent of the dogs used in experimental development of parathyroid tetany showed ulcers, but cats did not. Friedman[10] was able to produce ulcers and erosions in the duodenum of rabbits by injections of epinephrin and in the stomach, by pilocarpin.

While conclusions drawn from experimental demonstration of disease caused by dental infection are based on many fallacies, it has been my experience that undoubted benefit of definite and apparently specific nature follows the removal of infected teeth in certain conditions. It has not been often that removal of the teeth was depended on for results, other measures directed toward the patient's general condition being employed at the same time.

As in all bacterial disease, in addition to the presence of the infective organism itself, there must be conditions in the host favoring the development of systemic disease. To one person who develops disease, many carry infections from virulent bacteria without prejudice to health. Inherited and acquired alterations in body chemistry and structure are the associated factors in the development of disease from focal infection. An outstanding example is the influence of trauma. Osteomyelitis and osteoarthritis often follow an injury to the bone or joint which causes no open wound and therefore could not possibly introduce bacteria into the bone. Price[3] lays much stress on the calcium metabolism, as have others. Clinical experience would leave little doubt that there is a distinct hereditary tendency toward the development of rheumatoid conditions and cardiovascular-renal degeneration as well as other diseases. An infection superimposed upon such a constitutional basis will produce disease where it would not in another individual. Such factors as these, of necessity, cannot be determined or estimated accurately in any given person. Disturbances in metabolism, particularly the unknown influence of the vitamins on tissue cells, play a very important part in furnishing soil for the development of focal infection. Green and Mellanby[11] fed ninety-three rats a diet deficient in vitamin A. Postmortem examination revealed in ninety-one of them a high incidence of infections localized in abscesses involving the salivary glands, bladder and kidney, gastro-intestinal tract, middle ear and sinuses, and septic bronchopneumonia. Holman[12] found that a high carbohydrate diet made rabbits and guinea-pigs susceptible to abscesses from doses of *Staphylococcus aureus* which did not affect control animals. Cohen and

8. Rosenau, M. J., and Anderson: Hyg. Lab. Bull. 32, Washington, D. C.

9. Carlson, A. J.: J. A. M. A., 63:384, 1914.

10. Friedman, G. A.: J. M. Res., 38:449 (July) 1918.

11. Green, H. G., and Mellanby, Edward: Brit. M. J., 2:691 (Oct.) 1928.

12. Holman, W. L.: Arch. Path. & Lab. Med., 5:68 (Jan.) 1928.

Mendel,[13] by the use of a diet lacking in vitamin C, were able to produce tenderness, swelling and pain in the joints of growing animals. Another, and very striking example, is the abscess in diabetics, which disappears when the sugar metabolism is restored to normal. Price[14] and others interpret dental caries itself as primarily a local expression of physical disturbance. Various endocrine disturbances, through the resulting disturbance of metabolism, are capable of lowering what we may call resistance of an animal, for want of a more specific designation, thus predisposing to the production of disease from focal infection. Notable in this connection is the tendency of patients with hypothyroidism to develop chronic infections. Other conditions, such as heat, cold and fatigue, undoubtedly play a considerable part in furnishing a soil for the invasion of bacteria or their toxic products. The classic experiment of Pasteur in producing anthrax in the normally immune roosters by immersing them in cold water after injection of the bacteria is a striking illustration. Seigel[15] was able to produce nephritis in dogs by putting their feet in cold water. Pemberton,[16] in the study of 400 cases of arthritis in soldiers, found exposure to be an important factor (occurring in 58 per cent of cases). Among other precipitating factors, the next highest percentage was 8.25. Without going further into detail regarding the question of favoring influences in the host, it may be said that focal infection cannot be regarded as a specific agency bearing the same relationship to disease as the typhoid bacillus bears to typhoid fever.[17] It can also be seen that the importance of focal infection cannot be measured by bacteriologic standards, such as Koch's postulates, because it depends on that subtle and variable property, the ability of the individual to maintain a physical and chemical balance in the tissue cells.

Attempts have been made to demonstrate constitutional changes in the animal organism resulting from the presence of dental infection. Walter[18] describes the blood and constitutional changes in dental infection as involving a normal or low red cell count, low normal or low white cell count, relatively lowered polymorphonuclear count with relatively high lymphocyte count, the presence in the blood of "oral specific cells" above 1.5 per cent, lowered basal metabolism, low pulse rate, subnormal temperature and low blood calcium content. These changes may all well be regarded as due individually or collectively to constitutional conditions in the individual which favor the production of disease from focal infection rather than as the result of focal infection itself. Also, the specific cell referred to is probably another designation of the mononuclear cell of Florence Sabin. Another objection is that such changes are found singly, or in combination, in so many different conditions that they can be of little help in diagnosing the presence of dental infection.

The mode of conveyance of organisms from the primary focus of dental infection is probably most often by the blood

13. Cohen, C., and Mendel, L. B.: J. Biol. Chem., 31:149, 1917.

14. Price, W. A.: D. Cosmos, 72:1049 (Oct.) 1930.

15. Seigel, W.: Deutsch. med. Wchnschr., 34:454, 1908.

16. Pemberton, Ralph: Arthritis and Rheumatiod Conditions, Philadelphia: Lea & Febiger, 1929.

17. Pollia, J. A.: J. D. Res., 2:83 (Feb.) 1931.

18. Walter, Will: J. A. M. A., 85:1720 (Nov. 28) 1925.

stream. A bacteremia occurs much more frequently than would be supposed in the presence of chronic infection, and massive blood cultures, made with new refinements of technic, show that it is the rule rather than the exception that a bacteremia exists either continuously or intermittently in the presence of certain focal infections.[19]

I have previously stated that the proof of the relationship of focal infection to systemic disease is clinical rather than laboratory and experimental. The disease conditions receiving the most attention in relation to focal infection are those diseases which affect the serous and fibrous tissues, such as arthritis, fibrositis and endocarditis. As the literature on these subjects is voluminous, it is not necessary to enter into a prolonged discussion of these individual conditions. I have seen undoubted benefit in many cases of chronic arthritis from the elimination of questionable infection alone after all other measures had failed to produce relief, and after many cases of obvious focal infection had been previously corrected. There is the very distressing fact also that, while dental infection unquestionably is the final precipitating cause of some conditions, the removal of the infected teeth does not affect the outcome of the condition at all. Notable in this connection is the condition of bacterial endocarditis, in which a *Streptococcus viridans* infection in a tooth can be the cause of active bacterial infection of a previously damaged heart valve. The removal of infected teeth in this condition frequently accelerates the progress of the disease instead of curing it. My results in nephritis have been rather disappointing and the reported results are questionable. Many nervous conditions have been connected with dental infection, and Selling[20] calls attention to the connection of focal infection with tics in children, stating that beneficial results were obtained by removal of the infection. It has been my experience, as well as that of many writers on the subject, that peptic ulcer shows a much greater tendency to cure on medical treatment if all foci of infection are removed. The eradication of dental infection is by some authors[21] considered a valuable procedure in diabetes. On the other hand, Joslin[22] does not believe that infections are important in diabetes, having found them present in only about fifteen of 400 patients. My experience leads me to believe that removal of infection in diabetes is unquestionably of great benefit. It is a notorious fact that an acute infection of any nature greatly alters the diabetic's sugar metabolism. Diabetes has even been attributed by some writers to the action of toxins from focal infection in the islands of Langerhans. I have seen so-called "prediabetic" states clear up entirely after the extraction of infected teeth and without any other treatment.

There has recently appeared in the literature more and more discussion about the relation of focal infection to disease conditions ordinarily referred to as allergic. Clinical experience leaves little doubt with me that there is a decided allergic factor in the development of disease from focal infection. The character, for instance, of the joint changes in acute arthritis in which no bacteria can be demonstrated in the

19. Kendall, A. I.: Science, 74 (Aug. 7) 1931.

20. Selling, Laurence: Arch. Neurol. & Psychiat., 22:1163 (Dec.) 1929.

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joint fluid and the rapidity with which the acute inflammatory manifestations clear up after extraction of an infected tooth, sometimes within a very few hours, make it very probable that the joint manifestation is an allergic one, due to sensitization to bacterial toxin from infected teeth. Actual bacterial invasion of tissues causes proliferative changes, such as occur in infectious arthritis, and removal of the original focus does not clear up the joint condition without orthopedic treatment. Sir William Wilcox[23] states that autogenous intoxication from some focus of infection is much the commonest cause of asthma in adults. My experience would lead me to believe that this is true to a certain extent. Other allergic manifestations could be mentioned wherein dental infections could play a part, particularly some of the allergic dermatoses, urticaria being an outstanding example.

The indications for removal of potentially infected teeth are not always clear, and their determination depends on the exercise of a knowledge of both medicine and dental surgery and the rare quality of common sense. It is on this ground that the physician and oral surgeon meet, and there should be the closest cooperation and exchange of knowledge between the two. It might be said that to remove a potentially infected tooth can do no harm and should be done on general principles, even in the absence of disease. But there are times when, for mechanical reasons, such removal would result in great inconvenience and unnecessary expense. On the other hand, in the presence of some disease conditions of very serious nature, nothing could be more unwise than leaving *in situ* for mechanical reasons a tooth about which there exists the slightest suspicion of infection. Since it can never in any case be said positively that a tooth is or is not infected, or that it is or is not the cause of any given disease condition, the decision regarding its removal will depend on a careful consideration of the disease which the patient may have, together with a careful study of the tooth itself. A certain type of tooth may be extremely dangerous and a menace to the patient. On the other hand, "a good tooth in the head is worth two on a bridge."

23. Wilcox, William: Practitioner, 123:13 (July) 1929.

CONCLUSIONS

1. Clinical study by conservative and authoritative workers has shown that dental infection plays an important part in the causation of certain diseases and that its elimination is of great benefit in the cure of these diseases. My experience would support this point of view.

2. As dental infection is rarely the sole cause of disease, the various constitutional conditions must be given careful consideration. The detection of the dental infection and its elimination should not alone be depended on to produce a cure of disease.

3. There are no convincing facts presented to support the idea of specific localization of streptococci by experimental work on laboratory animals. Dental infection does not bear the same etiologic relationship to disease as does the presence of the organisms of specific disease, though these infections must be given serious consideration as of utmost importance.

4. The evidence of the importance of focal infections in the production of disease is clinical. Too many fallacies inherent in bacteriologic studies on the subject are seen to permit of considering dental infection as having any degree of specificity.

5. The valuable principle of focal infection in disease is assuming a more rational place in the practice of medicine and dentistry, but is still subject to much abuse. The thoughtful and careful workers in both the medical and the dental profession must combine their efforts to prevent such abuse as nearly as possible, first in the interest of the long suffering public, and next as a means of protecting themselves against criticism, which, it is feared, is sometimes deserved.

DISCUSSION

E. C. Hume, Louisville, Ky.: There is no question that a great number of systemic conditions are influenced by focal infection. I like Dr. Motley's method of saying that clinical manifestations should be given precedence over much of the laboratory work. As to the question of consultation and care of the patient, one of the greatest mistakes that we make as a profession is proneness to care only for the local condition in the presence of a systemic disturbance and not to advise the patient to consult a physician. It is our obligation to advise such patients of the importance of seeing the family physician, immediately, preferably before any dental work is done; just as much as it is to eliminate the oral infection which is present. My association with physicians has been pleasant. The majority of them, when treated cordially and in the professional spirit, will give the very best they have.

A. B. Vastine, Danville, Pa.: I should like to ask Dr. Motley whether I understood him to say that Vincent's organism is not in any way directly responsible for a systemic disease. I feel that I could not let such a statement go unchallenged as it has been my privilege to deal extensively with this type of infection. Recently, we have been carrying on some work which very strongly points to Vincent's spirillum as being, at least, the primary organism in the direct attack on the lymphatic structures, such as the tonsils and other lymphoid tissue within the oral and nasopharyngeal cavities. These conditions have been associated with such blood dyscrasias as agranulocytosis or agranulocytic angina and the acute lymphatic leukemias. Specific chemotherapy for Vincent's infection in these tissues has so far in our experience relieved the patients. We have been able to raise the white blood cell count from below 1,000 to 4,000 or more in a period of twenty-four to forty-eight hours. We have also been able to care for certain types of lung involvement when Vincent's spirilla have been demonstrated as the infecting organism. Our own studies convince us that Vincent's organism is most frequently the invader that prepares the way for the subgingival cyst or the sinusitis by the subgingival pathway. While Vincent's spirillum may not be the actual focal organism, it may prepare the local field for the establishment of the focal mechanism, thus becoming a part of the cycle resulting in the focal syndrome. Experience convinces me that it is very unsafe to make the statement, in view of our present knowledge, that the spirilla of Vincent are not in any way directly responsible for disease.

Earle H. Thomas, Chicago, Ill.: There is one phase of this subject to which I would like particularly to call your attention. In the past, medical statistics and case histories, from the standpoint of whether focal infection from diseased teeth was the cause of serious systemic conditions, were unreliable, if not worthless. Before the advent of the roentgenogram, there was, in most cases, no positive means of diagnosing chronic apical infection. Therefore, no reliance is to be placed on a quotation from a case history of several years ago which reads "teeth negative," or which asserts that three or four diseased teeth were removed (all mouth infection was eliminated), and the systemic condition was not benefited; and, therefore, the teeth had no relation to it. Even today when full mouth roentgenograms are considered a necessary adjunct to other means of oral diagnosis, we find a large proportion of the medical and dental professions ignoring this fact and relying solely on clinical appearances and symptoms of pain and soreness, the latter of which is entirely lacking in most chronic disease conditions of the teeth. But aside from this, even when roentgenograms are made, I wonder if it is generally realized that a large proportion of physicians and dentists are so woefully lacking in ability to make a competent interpretation that much mouth infection is overlooked or are so unappreciative of the serious detrimental possibilities of minor conditions that these are ignored. Furthermore, it must be mentioned in this regard that a roentgenographic ex-

amination, unless interpreted in conjunction with a competent mouth examination and history, is fallacious to say the least, and thus we must realize the worthlessness of the x-ray laboratory so-called "diagnosis." Therefore, many case histories published today, in which statements are made that all mouth infection was eliminated, may be open to question. Dr. Motley has said that even though the teeth were the original source of some disease conditions, removing the teeth might not bring relief because the disease was well established in its new location. He also made the remark that, in some cases (endocarditis, for instance), removing the offending teeth might possibly make the condition worse. That brings up the question as to why we wait until it is too late before we remove the teeth. I have not yet come to the stage of ordering out all pulpless teeth if the patient is in health. Yet I often wonder whether we should allow to remain in the mouth any condition that can and may cause serious systemic trouble if the patient's resistance becomes lowered.

Dr. Motley: There is much to be said on both sides. It is too bad to allow a patient to leave a pulpless tooth in his head for a year or so when he is apparently perfectly healthy, and then have him develop a condition wherein removal would be locking the stable after the horse is gone. But those conditions nearly always fall within a class which can be illustrated by bacterial endocarditis, a disease which develops on a previously damaged heart valve. If a patient is properly studied before he develops bacterial endocarditis, a damaged heart valve will be found before he develops endocarditis in an active form. As I said before, circumstances alter cases. In that case, I would not allow a tooth which is in the slightest degree suspicious to remain in the head. To remove such a tooth will be locking the stable before the horse is gone. Why people wait until those things occur is a question. Perhaps it is just nothing but human nature. I, myself, not altogether for prophylactic reasons, have had all devitalized teeth removed and I am not at all sorry. There are times to leave teeth in and times to take them out. As to the question of Vincent's infection, there is much to be said on both sides. Whether a case of Vincent's infection is the cause of agranulocytosis is doubtful. We can produce agranulocytosis in man, and it does occur clinically more often than we would like to see it, by the injection of arsphenamin, which affects the bone marrow. The second symptom that appears in this condition is necrotic ulcers of the mouth, the first being reduction of granulocytes in the circulation. We say systemic invasion never occurs in abscess of the lung. When there is a necrotic area, we find Vincent's organisms in the sputum, but these organisms are secondary invaders and do not cause the abscess. Vincent's infection causes a local reaction in the mouth, an acute gingivitis, which appears on tissue showing chronic pyorrhea or on an otherwise damaged gum; but Vincent's organism can be found in the mouth of every one of us here who do not wear complete dentures. No one organ or system of organs in the body is independent of the remainder of the body, and cannot be so treated.

IMPORTANCE OF EARLY STUDY OF THE THIRD MOLARS*

By HORACE M. DAVIS, D.D.S., Baltimore, Md.

UNQUESTIONABLY, in many instances the third molar is a source of discomfort as well as a menace to the human race. Why is so little consideration given by dental practitioners to this undeniable fact? Is their attitude due to indifference and negligence? We might say, to some extent, yes, but more often it is due to a lack of knowledge that such conditions exist. We are creatures of habit, and as we are taught in the beginning, so are we, with slight deviation, apt to continue in practice.

Previous to the present time, dental schools have not definitely laid stress on the importance of an early study of the third molar (if so, it has not come to my attention). Much has been written about third molars, especially impacted mandibular molars and what to do with them, the research work of George B. Winter being outstanding, but practically nothing has been done to show reasons for routinely trying to prevent the damage these teeth do.

J. B. Jenkins writes of "Twenty-Four Disorders Associated with Impacted Wisdom Teeth." Whether there are that many, or whether more or less it is beyond my ability to determine, but there is no doubt that the third molars cause so much disturbance, known and unknown, as demonstrated by pain and malformation, that there is every reason to consider them early in life rather than to advise our patients to "wait until they cause you trouble." Do not think that I believe all third molars should be removed—far from it. They have their normal function, and when they are a force for good, it is as important that they be retained as it is to remove them when only grief can come from their retention. I believe that at times the removal of the second molars may be of prime importance, permitting the third molars to become useful teeth.

"The Importance of Early Study of the Third Molars" expresses precisely what is meant. No attempt is here made to say what shall be done at the time of the examination, since only the individual operator and his consultants can determine this, but as we undertake to put into effect a consideration of these molars at an early age, light will gradually dawn on us as to the needs of the patients and, in a little while, we will recognize the great service we are rendering them.

Can any one here give a good reason why a useless tooth should remain in the mouth until it gives pain and forces the patient to have it removed, unless, by the removal of the tooth, a worse condition may be brought about? Most of us have the responsibility of advising and guiding our patients as to the present and future condition of their teeth. If our conception of this responsibility is only

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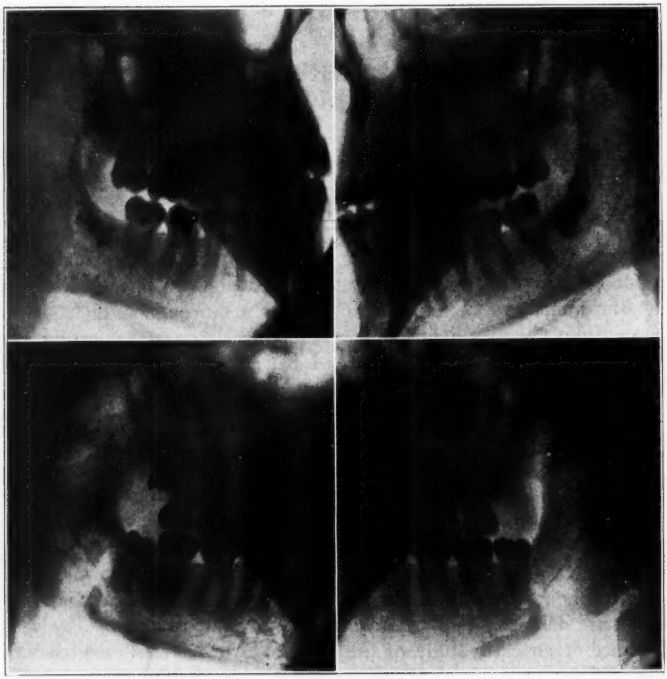

Fig. 1.—Extra-oral films of the teeth of a boy, aged 16 (above) and his sister, also aged 16 (below). In one of these cases, the third molars are almost fully developed, while in the other they are but slightly developed. These two cases with many others studied prove that age is not a factor in determining to what extent the third molars may be developed.

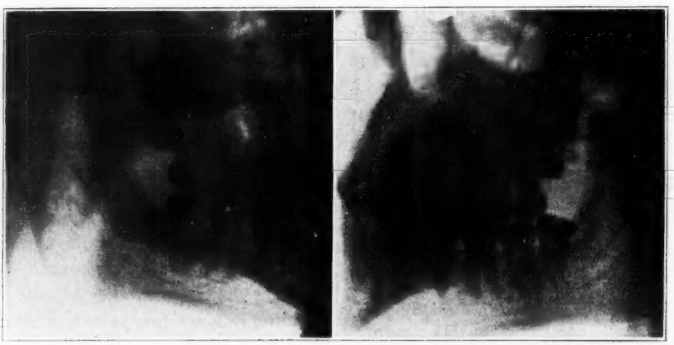

Fig. 2.—Appearance of jaws showing position of third molars and destruction to the upper second molars by the impacted third molars. The patient, a young man, had suffered almost continuously with headaches from the age of 17 to 21. On removal of the teeth (Fig. 3), the headaches ceased.

the filling of cavities and the extraction of aching teeth, we fall far short of being worthy advisors of our patients.

The x-ray machine has become a fixture in dental offices, and with it the overhead is necessarily higher. Some of our most prominent men are concerned about the high cost of dentistry to the public and the effect it will ultimately have on the profession, but no sincere operator should permit this factor to prevent him from rendering a complete service to his patients, because the most expensive of all dentistry is that which is inefficiently done, and, after all, the actual cost to us for a number of roentgenograms sufficient to assure that we can do our best is so small that it should not

Fig. 3.—Upper second molars which suffered injury from presence of third molars shown in Figure 2.

be considered a factor even in charity cases.

Now to be more specific. What are some of the reasons that we should carry out these routine examinations of the young people in our care? One with sufficient experience knows that there is no age limit when we are considering the damage that a third molar does or at least gets credit for doing. George C. Fahy[1] writes that "Many of the impacted third molars are carried through life causing neither local disturbance nor giving rise to cerebral or other reflexes." I am reminded of a friend of mine who had the habit of asking, when a statement was made to him, "How do you know?" He was cured of this habit by his friends, deciding to ask him, when he made a statement, "How do you know?" We believe many conditions to exist whose existence we are unable to prove. This much we do know: the impacted or imbedded third molar is an abnormality and the sooner we recognize this fact and give study to its future, the sooner we shall give our patients a better service.

George Fahy also writes[1]:

> Seventy-five per cent of the orthodontists feel that this erupting third molar does and can have an effect not only on the adjacent second molar but on the other teeth in the arch. Twenty-five per cent of the orthodontists say definitely that this is not so. As a matter of fact, in this twenty-five per cent we find many of the prominent men. . . .
>
> My belief, based on a number of years of observation, is that this erupting third molar has in many instances a very definite action on the other teeth.

Fahy's paper was printed in 1926. Five years later, almost 100 per cent of the orthodontists, I believe, recognize the fact that not only the erupting third molars but also the malposed third molars that never will erupt have a very definite action on the other teeth in the mouth, and here let me say that the orthodontists, in their effort to carry out Nature's idea of perfection, have done much to concentrate attention on the third molar.

Let us deal with the third molars from childhood to old age. It is admitted that irregularities and deformities in the mouths of many children are caused by these teeth, as well as cysts, nervous diseases, etc. At a later period, it may be at from 16 to 25 or later, we see, in addition to the foregoing, crowding of the anterior teeth and infected areas on the distal surface of partially erupted

1. Fahy, G. C.: Dent. Cosmos, 68:53 (Jan.) 1926.

lower third molars, the latter in many instances harboring organisms which may be the cause of acute Vincent's infection or acute infections such as tonsillitis, osteomyelitis and cellulitis. During this period, also, the upper third molars may be the cause of much that is damaging, destroying the roots and pulps of the second molars, driving distally into the zygomatic regions or erupting toward the cheeks, malignancy possibly resulting.

Later in life, whether it be at 30 or 70, many of the diseases to which we are subject come under the heading of conditions in which the teeth must be considered as factors. To find at this stage of life that impacted teeth are present and must be removed under adverse conditions is an indictment of our previous attention to these patients. Most operations for young people appear simple in comparison with the same operation in older persons. Therefore, if impacted teeth should be removed, by all means

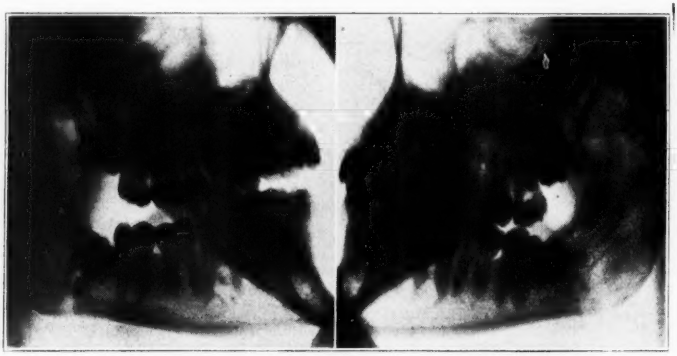

Fig. 4.—Completed orthodontic case with third molars well locked in; demonstrating need for study as to advisability of removing these teeth at an earlier period.

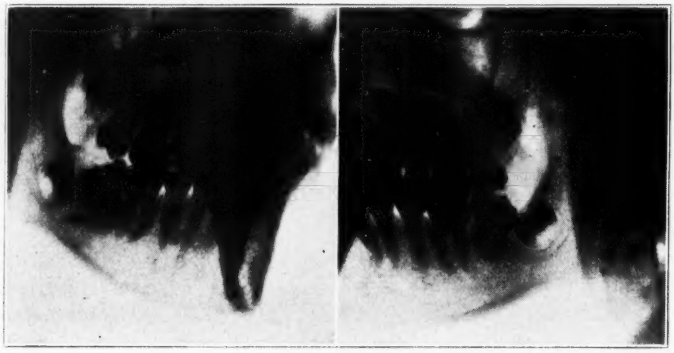

Fig. 5.—Case in which it was decided, because of poor occlusion of second molars and lack of development of third molars, to remove second molars instead of third and observe result. The second molars, as here shown, were removed at the age of 16½. (Compare Figs. 6-8.)

let us remove them or have them removed when the patient is young and in good health. If this procedure does nothing more than eliminate an important factor in the ills incident to later life and permit the physician to make his diagnosis without this additional complication, much has been accomplished.

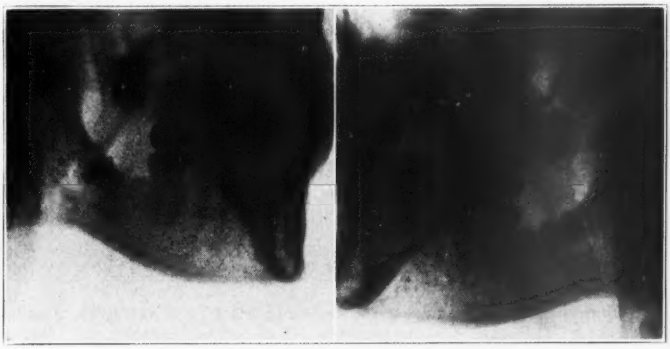

Fig. 6.—Position of third molars in case shown in Figure 5; at age of 17. (Compare also Figures 7-8.)

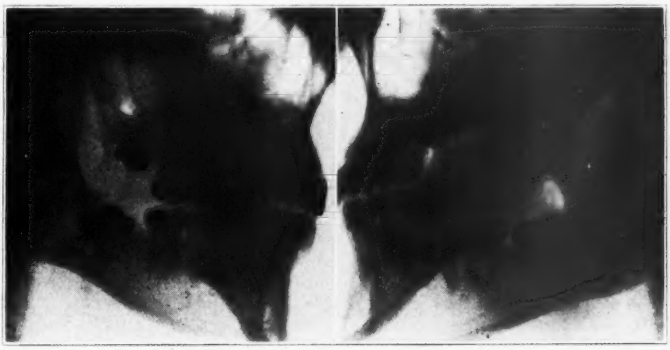

Fig. 7.—Position of third molars in case shown in Figures 5-6; at age of 18. (Compare also Figure 8.)

We dentists must accept as our responsibility the elimination of those mouth conditions that have so much effect on the general health, and in spite of the fact that we appreciate the dangers of periapical and periodontal infection, as bad as they are, we believe, all things considered, that the third molar is the worst offender—"the snake in the grass."

REPORT OF CASE

A medical student, aged, 21, white, first noticed headaches at the age of 15. He thought that they were from a broken nose, the injury occurring a few years before. Operation performed on the nasal septum when the patient was nearly 17 brought about a decrease in the frequency of the attacks, which were usually accompanied by nausea. This went on for about a year, when the headaches became

more frequent. They came with increasing regularity until they were occurring about two or three times a week. When the patient was 20 years old, glasses were obtained, but they had no marked effect. Medicine, and diet to increase the activity of the liver were employed in the summer of 1931, diminishing the nausea and pain, but not the frequency of the headaches. Late in September, 1930, the upper second molars and lower third molars were removed. Headache occurred every afternoon for one week. Since then, there has been but one headache, accompanied by nausea. The last extraction was performed September 28.

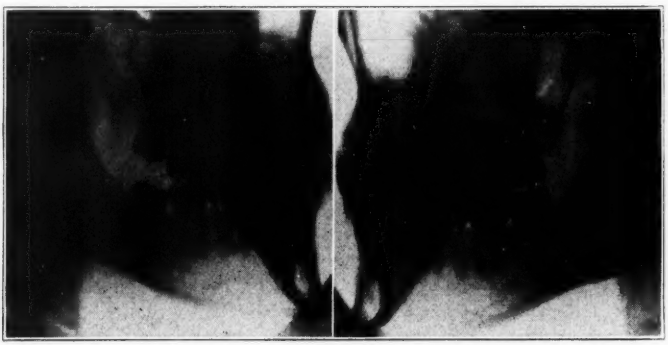

Fig. 8.—Position of third molars in case shown in Figures 5-7; at age of 18. Further development is expected. This case demonstrates that if the second molars are removed early enough, the patient will at times have better occluding teeth with the third molars coming into the position of the second molars. The foregoing procedure made unnecessary rather extensive operations which would have been necessary to eliminate the third molars.

Fig. 9.—Typical case of ill patient well advanced in years showing badly impacted teeth that must be removed under adverse conditions.

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Editorials

THE YOUNG PRACTITIONER

At this season of the year, when the schools are sending out their annual product of new material to launch on the sea of professional life, it is always salutary to study the possible effect of an influx of new members on the profession and on the public. It is a very vital matter, first, to prepare the new recruits in a technical and scientific way so that they are well equipped to meet the concrete problems that are likely to confront them in their every day practice, and, secondly, to so direct their ethical tendencies that their approach to their future career shall constitute a distinct contribution to the finer and more exalted conception of what is embodied in real professionalism.

It matters much what the attitude of these new recruits really is. Soon they are to constitute the bone and sinew of dentistry, soon they are to be the profession. Important as their technical training may be, and vital as it is to have their scientific equipment meet the demands of the increasing requirements for skilful

service and adequate diagnostic acumen, there is something beyond all of this that most intimately affects the very structure of our calling. That is the ethical attitude of the rank and file of those who make up our profession.

We may flout ethics all we wish, and sneer at the so-called archaic attitude of some of the old stalwarts of the profession, but it is this one thing in ethics that has made dentistry what it is. Without the principles enunciated and contended for by a goodly number of the pioneers, many of whom would today be charged with being impractical, we would never have had a profession.

There is a latter day tendency to smash our images and toss them into the discard. Very well; but we would better have a care as to what we put in their places. A certain amount of radicalism may be salutary. It may be essential at times to "stir up the dry bones," and to "have a new deal," but when the fundamentals of our professional structure are tampered with in the name of so-called progress, the result is disastrous. It is always a mistake to tear down faster than you can build up, and there is apparently a growing element who think more about tearing down than they do about building up. Progress should be the order of the age, but mere radicalism is not necessarily progress. Too often, it is the reverse.

This is the lesson that our young men and women who are being graduated today need most to learn. With open arms, we bid them welcome into the great brotherhood of this profession of ours. Without the stimulating influence of the infusion of new blood into the profession all the while, we would soon suffer the penalty of stagnation. Anything is better than stagnation, anything better than dry rot. But we must have a care that when the new blood comes in, it shall not be vitiated by the virus of false doctrine. To avoid the danger of bad blood pouring into our ranks, we must look carefully at the source and keep the stream purified by idealism.

There seems to be a tendency today for many of our novitiates to run after false gods. The trend of the times is such that materi-

alism is made very attractive, and idealism is accounted old-fashioned. Well, let us see. Mere materialism has not achieved one single worthy purpose in any of the professions. Idealism has built most of the sacrificial altars and sanctified them with the sublimity of service. We cannot expect youth to get the full vision of true professionalism till such time as sacrifices are made and service is enthroned as king. Not till we give much shall we receive much —this is the lesson of the ages.

Out of the welter of our desires and the impetuosity of our youth comes the germ that invites demoralization. It is most inspiring to see the enthusiasm and energy that are brought into professional life by the influx of recent graduates, but unless this new force is properly directed and guided into ethical channels, the effect on the future of the profession may well be disastrous. Mere enthusiasm and energy do not necessarily imply added professional welfare; they may run counter to the proper course, and do more harm than good.

At this point, it might be well to refer to a practical suggestion that has been made concerning a certain means that might be employed to encourage and direct our recent graduates. We all recognize the patent necessity of getting as many of them into dental society work as possible. The only salvation of the profession is to foster organized dentistry and we need a representative membership of this class. The suggestion has been made that our societies admit new graduates for a stated period into full membership at substantially reduced dues. It is felt that this might induce many to seek membership who otherwise would not feel that they could afford it, and, once in the society, the prospect for holding them would be much better than to attempt to get them in after they have been out of school a few years. This idea is certainly worthy of careful consideration, and we commend it to the attention of our society officials.

One thing is increasingly important, and that is that the older members of the profession shall take a vital interest in the welfare of the coming graduates, and extend to them the right hand of fel-

lowship. "No man ever died of too much encouragement," and no young graduate was ever greatly injured by a kind and encouraging word from a man his senior. We are too inclined to forget these amenities in the absorbing activities of professional life, but of one thing we may be certain: we shall never improve the tone or the personnel of our profession unless we have a proper regard for the duty we owe our coming generation of dentists in the way of encouragement and guidance.

A JOLT TO THE ROUTINE

The even tenor of your way runs along day after day, week after week, month after month and year after year. The routine of your life becomes almost rhythmic. So very much is routine, so very little is revolutionary. The machinery of your duties clicks along with almost monotonous regularity. Each day's work is planned in advance; almost every hour is accounted for weeks ahead. You become so much a creature of habit that you go about your affairs almost automatically. You waken at the same hour, spend the usual time at breakfast and step on the early bus almost without volition on your part. Through sheer force of habit, as you near town you turn your head to look at the clock on the tower to see if the bus is on time. The importance of promptness has become almost an obsession with you.

Well, why not? Does not the orderly performance of your work constitute an essential element of comfort in meeting the demands of the day? There are others to think about. After all, you are merely a cog in a wheel, and there is some importance attached to the problem of helping to keep the machinery moving. Your duties are interwoven with those of other people and there is an immense satisfaction in feeling that you are doing your share and playing the game as manfully as you may.

But suddenly all of this is changed. One morning you do not go to town. The thing is incongruous. All of your engagements are made as usual and your plans are laid, but you do not go to

town. Something has gone wrong. Instead of the trip on the bus. there is a ring at the door bell and your physician comes upstairs to your room. What an angel of mercy and light he is! A few reassuring words from him, and at once you feel better. But—it is not all so easy as that. Coupled with those few kind words from him, there is the admonition that you must remain in bed.

Remain in bed! It is broad daylight and you have all of your appointments to think about. Remain in bed! Good heavens, doesn't the man know of your engagements? It is the most arbitrary thing that has ever come into your life. Remain in bed! The thing is impossible. It is a cruel assault on your habit of mind, and an impetuous rebellion rises up in you at once. But quietly and calmly your physician has his way, and in your heart you know that he is right.

All of that beautiful routine of yours has been swept aside as ruthlessly as if it did not mean a thing. The struggle is terrific for a time, but perforce you are obliged to succumb "for just this one day." At once, you begin to lay plans to double up on the lost day and do added duty the next. That monster routine has you in his grip, and is still riding you hard.

But the next day you do not go to town, or the next, or the next. There is still a straining at the collar, but the strain is gradually weakening. Weeks pass. The awful thought begins to break in on you that the affairs of the world are moving along much as usual, and it is quite a shock to you. Then you analyze the situation and try to be philosophical about it, but there is this one thing that confronts you with ever-increasing force: While the world may be moving as usual, your own little orbit, insignificant as it may be, is not functioning as it should, and you become more and more aware of it. After all, that is *your* orbit. You have built around it by months and years of effort, and its associations have become very precious to you. You cannot, to save your very life, ignore that orbit of yours completely. You are drawn here and there between the meshes of your desires and the stern necessities that encompass you. You are confronted with an environment that in the very nature of things is alien to you and you chafe under it.

It is needless to tell you at that moment that you should be philosophical and resign yourself to the present situation. All the philosophy at your command is not sufficient to wholly reconcile you to this ruthless interference with your individual routine. Something has intruded itself on your life, and your rebellion well nigh overpowers you.

In desperation you send for your mail, and oh, the blessed comfort of those letters. You begin to pick up the loose threads again, with the good doctor looking askance at you occasionally, and sometimes even shaking his head at you. More and more, you begin to edge into the picture again, bit by bit you crowd out the doctor's admonitions. All the while you realize that you are being a trifle perverse and wilful about it, and deep down in your heart you thoroughly sympathize with the doctor. You would not disobey his orders for anything in the world, but in spite of all your resolutions, you find yourself inserting the thin edge of a wedge here and there to force the situation, and at each visit there is the subtle, almost the surreptitious, hint for a privilege that is really unreasonable.

Finally the doctor, yielding it may be against his better judgment, tells you that you may "put on your clothes." The triumph of that moment! You are a bit wabbly, but you will not admit it. Your feet do not track quite right, but you are on your way.

One morning, you take the early bus, look for the familiar scenes along the street, glance at the big clock on the tower, and oh, how good the work does taste!

MR. GEORGE EASTMAN'S DENTAL BENEFACTIONS TO BE MAINTAINED

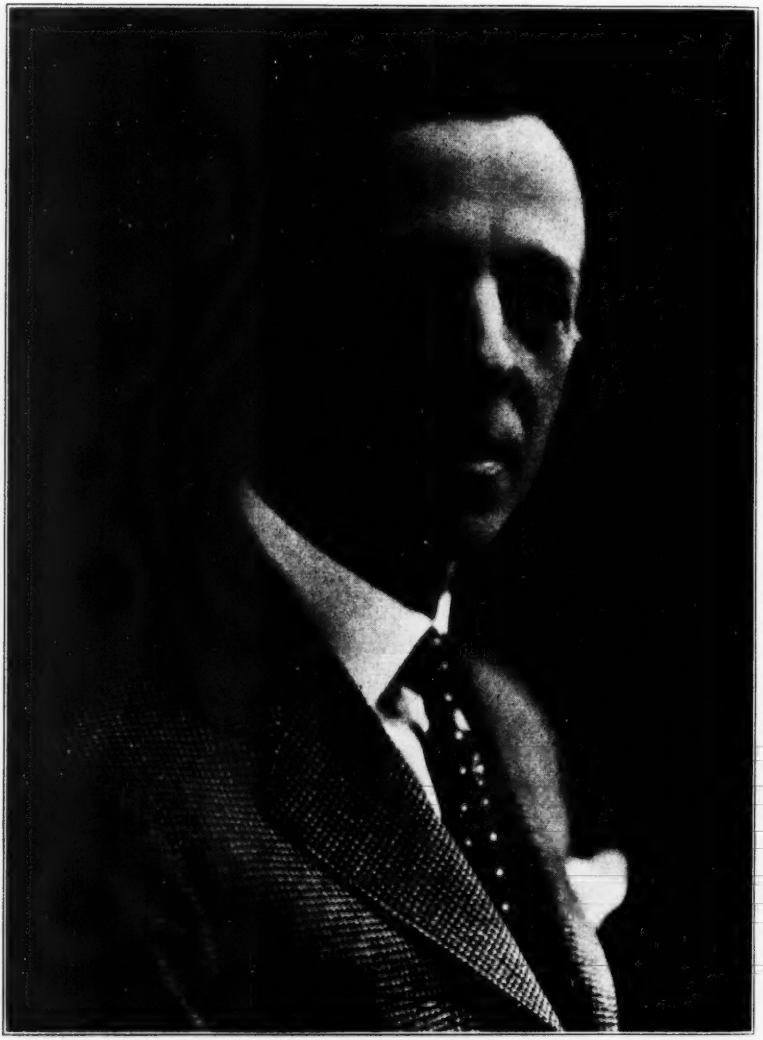
Following the death of Mr. Eastman, in March, there was naturally some conjecture as to the status of the various dental clinics that had been established through his generosity in different parts of the world. It was felt that the splendid vision of the man who had conceived the idea of helping the children of the world through

the medium of dental care must have been far-reaching enough to make provision for their subsequent maintenance, and this turns out to be the case.

In a letter to the Editor from Rome, Italy, written by Dr. Harvey J. Burkhart, who was abroad at the time of Mr. Eastman's death, the assurance is given that the dental clinics are to be maintained in accordance with their benefactor's wish. This is very gratifying news, not only to the dental world but also to the world at large.

It was well known that of all the philanthropies inaugurated by Mr. Eastman, the ones connected with the dental clinics gave him the greatest satisfaction and elicited from him the most wholesouled commendation. The reason for this is not far to seek. Through good fortune, the direction of the dental clinics, from the first one at Rochester to the latest one at Rome, was placed in the hands of the one man best qualified to carry these enterprises to a successful issue. Dr. Burkhart from the very beginning demonstrated those rare qualities of mind and heart that fitted him most effectually for the task of leadership in a movement that called for balanced judgment and untiring effort. He has devoted himself unreservedly to the welfare of everyone connected with the clinics, from the wise and philanthropic founder to the citizens of the countries in which the clinics were located, and particularly to the hosts of children who were to be the beneficiaries of this humanitarian enterprise. He has gone about his task with signal ability, and without affectation. Quietly and at a great personal sacrifice to himself, he has executed every trust reposed in him in a manner to win the approbation of everyone concerned.

No wonder that Mr. Eastman placed such confidence in Dr. Burkhart, and gave him his unreserved loyalty and support. It was well known that there had grown up between these two men a friendship, even a comradeship, that meant much to each of them; and the man to most genuinely miss today the kindly face of the benefactor will be the director with whom he worked so many fruitful years.



HERMAN A. MAVES, D.D.S.
(1879-1932)

Doubtless neither of these men with their constitutional lack of ostentation would welcome commendation such as we have just voiced, but in this matter-of-fact world, with such a flair for practicality, it will do no harm and we venture to hope that it may do some good, to stop at times and say a word of encouragement where encouragement is so richly merited.

The world is a better world today because George Eastman lived and labored in it, and because Harvey Burkhart has had the brain and the will to carry out and make manifest the splendid vision that illumined the mind of his benefactor. Generations may rise and depart, but the influence of this philanthropy will never cease to exist as long as men have noble impulses and children are prone to suffer.

FINDING FAULT

Some writer has said, "Nothing is easier than finding fault; no talent, no self-denial, no brains, no character are required to set up in the grumbling business." Just plain perversity is all that is needed. The meanest mind with scarcely a brain cell working can find fault. It does not require intelligence, or initiative, or originality, or vision. All that it requires is smallness, or envy, or suspicion, or meddlesomeness. To find fault is the prerogative of small souls, and the stock in trade of the disgruntled. To be continually finding fault with others is to herald your own limitations. To find fault is not to achieve peace of mind; it is to breed discontent and unhappiness. Expend your energy and relieve your tension in some other way. Swear a little if you must, but do not find fault.

HERMAN A. MAVES, D.D.S.

(1879-1932)

Herman A. Maves was born in Belgard, Germany, May 30, 1879; died, March 19, 1932, at a hospital in Minneapolis, after a three days' illness with pneumonia, contracted on his way home from giving a clinic at Atlanta, Ga.

Dr. Maves had lived in this country since he was 2 years of age. His parents settled in St. Peter, Minn., and he received his early education at Gustavus Adolphus College. He later attended the University of Minnesota College of Dentistry, graduating in 1905.

He practiced in Faribault, Minn., for one year and then came to Minneapolis, where he resided at the time of his death. He was assistant professor of operative dentistry in his alma mater from 1907 to 1916, when he became professor of oral surgery, continuing in this position until the time of his death.

Dr. Maves served as president of his state society in 1917, was a member of the Judiciary Council of the American Dental Association, 1920-1922, a member of Delta Sigma Delta fraternity and was the newly elected president of the American Academy of Restorative Dentistry.

The widow, two sons and three brothers survive.

WILLIAM H. DeFORD, A.M., D.D.S., M.D.

(1858-1932)

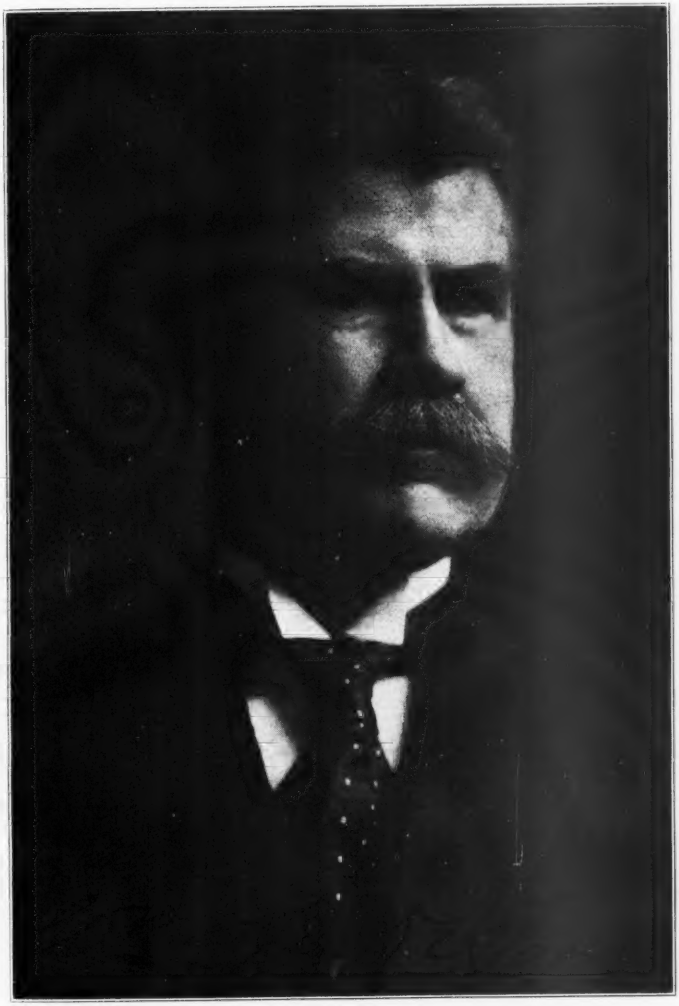
William H. DeFord was born in Centerville, Md., June 3, 1858; died March 22, 1932, at Des Moines, Iowa.

He graduated from Western Maryland College in 1880 with the degree of A.B., and in 1883 received the degree of A.M. He obtain the degree of D.D.S. from the Baltimore College of Dental Surgery in 1882 and the degree of M.D. from the College of Physicians and Surgeons of Baltimore in 1883.

Dr. DeFord succeeded G. V. Black as professor of pathology and oral hygiene in the College of Dentistry of the State University of Iowa in 1891, and held the chair of pathology, oral hygiene and anesthetics until 1902. He was at one time president of the Iowa State Board of Dental Examiners and also of the state dental society. The anesthetic supplement of the *American Journal of Surgery* was at one time edited by him, and he was also the editor of the *Dental Record,* 1908-1913. He served as professor of dental surgery and anesthetics at Drake University College of Medicine, 1907-1913, and acted as dean of the College of Dentistry, Drake University, 1908, where he was also professor of pathology, anesthetics and exodontia.

Dr. DeFord was a member of the American Dental Association, American Association of Anesthetists, National Association of Dental Examiners, National Association of Dental Teachers and Ninth International Medical Congress, and honorary member of the St. Louis Society of Dental Science, the Los Angeles Oral Surgery Club and of the Kansas, Nebraska, Missouri and Colorado state dental societies. He was the author of a book entitled, "The Use of General Anesthetics in Dentistry Advocating Painless Dental Operations by the Use of Nitrous Oxid, Nitrous Oxid and Oxygen, Chloroform Analgesia, Ethyl Chloride and Somnoform," published in 1908 and rewritten and enlarged in 1912.

It is believed that Dr. DeFord was among the first, if not the first, to advocate the use of analgesia in dental and surgical operations. In 1880, he performed the various operations on the teeth, other than extracting, after inducing analgesia by



WILLIAM H. DeFORD, A.M., D.D.S., M.D.
(1858-1932)

the use of nitrous oxid. Because of the simplicity of the apparatus for administering chloroform, Dr. DeFord became an advocate of the employment of chloroform as well as nitrous oxid in painful dental operations, and this led to the writing of the book mentioned above. After ten years of private practice with analgesia in his office, Dr. DeFord, having satisfied himself that surgical and dental operations could be performed safely and painlessly with benefit to both patient and operator, demonstrated this fact by clinics and lectures in nearly every state in the Union. He invented several types of nitrous oxid and somnoform inhalers and accessory devices.

Jessie R. DeFord, D.D.S., survives her husband.

Dr. DeFord was the possessor of a fine medical and dental library which he turned over to the American Dental Association some years ago. These books, in fact, became the nucleus of the present Association Library collection.

JOHN WILLIAM SMITH, D.D.S.
(1861-1932)

John William Smith, D.D.S., died March 20, 1932, at the Maryland General Hospital, Baltimore, Md., from bronchial pneumonia, in his seventy-first year.

Dr. Smith was born in Wheatland, Loudon County, Virginia, Dec. 31, 1861, the son of James William Nixon and Ann Elizabeth Curry Smith. He obtained his early education in the public schools of Loudon County, and Washington, D. C. In early life, he engaged in farming, the love for which remained with him throughout his life.

He matriculated at the Baltimore College of Dental Surgery in the fall of 1886, graduating in 1888. While a student, he became associated with William B. Finney, who for many years was professor of prosthetic dentistry at the Baltimore College of Dental Surgery. After graduating, he became assistant demonstrator of prosthetic dentistry, associating himself with Dr. Finney, with whom he remained for several years.

In 1895, Dr. Smith, together with J. Edgar Orrison and a number of prominent physicians, organized the dental department of the Baltimore Medical College. He was elected dean and, except for a period of two years, during a part of which time he was in Colorado on account of ill health, he served in that capacity until the Baltimore Medical College merged with the University of Maryland, in 1913, occupying the chair of prosthetic dentistry until his retirement from the faculty in 1919. He was extremely interested in dental prosthetics, in which branch of dentistry he was very painstaking and skilful.

Dr. Smith was for many years a member of the American Dental Association, the Maryland State Dental Association, and the Maryland State Past Presidents Association. He was president of the Maryland State Dental Association in 1908-1909.

Dr. Smith married Miss Martha Annetta Schott of Baltimore, who survives him.

HERBERT F. GORGAS

COUNCIL ON DENTAL THERAPEUTICS

DENTAL SIGNIFICANCE OF FLUORID IN DIETARY AND THERAPEUTIC PRODUCTS

By FLOYD DeEDS, San Francisco, Calif.*

The Council has authorized publication of the following as one of the series of articles on pharmacology and therapeutics.

SAMUEL M. GORDON, *Secretary.*

For many years, the dental profession has been puzzled by a condition known as mottling of the teeth. In the United States, the condition is endemic in certain areas of Arizona, Colorado, Texas, Kansas, New Mexico, Virginia, Arkansas, Illinois and the Dakotas. From indirect evidence, it had long been suspected that the drinking water of these areas was in some way responsible for the condition. Many analyses of water from these areas revealed nothing that could logically be designated as an etiologic factor, but none of these analyses included an estimation of fluorin, which is now believed to be the causative factor.

Experimental evidence that fluorin is responsible for the occurrence of mottling of the enamel existed at least as early as 1925 in the researches of E. V. McCollum and his associates[1] and of Cristiani and his co-workers.[2] McCollum pointed out that during the course of feeding experiments in which white rats were placed on diets supposed to be adequate in every respect, there developed in some groups an abnormality of the teeth, always more pronounced in the incisors. Proceeding on the usual assumption in nutritional investigations that abnormalities are the result of a lack, complete or partial, of some indispensable constituent, and that fluorin is a normal constituent of teeth, E. V. McCollum and his group conducted feeding experiments in which an adequate fluorin intake was assured by adding sodium fluorid (226 parts per million) to the diet. Instead of escaping the abnormality, all animals on the fluorid diet developed poor teeth and overgrown incisors; whereas, the control group, which received no fluorid in the diet, developed normal teeth. Fluorin occurs normally, and in variable amounts, in many normal food products, owing to the fluorin content of the soil and water supply. The obvious conclusion is that the results with diets supposed to be normal were variable with respect to the development of good teeth owing to a variable and at times too high content of

*Senior toxicologist, U. S. Department of Agriculture, Bureau of Chemistry and Soils, at the Department of Pharmacology, Stanford University School of Medicine.

1. McCollum, E. V., et al.: J. Biol. Chem., 63:553 (April) 1925.

2. Cristiani, H., and Gautier, R.: Compt. rend. soc. de biol., 92:139 (Jan. 30), 946 (April 13), 1276 (May 15); 93:911,912 (Oct. 23) 1925.

naturally occurring fluorin. The experimental evidence obtained was not associated until quite recently with a puzzling problem of dental interest; namely, mottled teeth.

In March, 1931, H. V. Churchill, who had been making spectrographic examination of water in this country, suggested that fluorin, for which analyses had not been made previously, was the etiologic factor in mottled enamel. In June, 1931, M. C. Smith, E. M. Lantz and H. V. Smith of the College of Agriculture, University of Arizona, published a bulletin[3] in which the rôle of fluorin in mottling of the enamel was definitely established. Well-water containing as little as 2 mg. of fluorin per liter can produce the condition. These investigators have produced mottling of the teeth in white rats by adding to the diet either sodium fluorid or the residue of drinking water from the endemic area of St. David, Ariz. More recently,[4] they have reported the successful production of this condition in dogs.

Since as little as 2 mg. of fluorin per liter a day can produce mottling at an age when the enamel of the permanent teeth is being laid down, it follows that a child weighing from 10 to 15 kg. (21 to 31 pounds) and drinking a liter of liquid, including milk which may contain fluorin, a day is receiving a daily dose of from 0.13 to 0.20 mg. fluorin per kilogram of body weight. From the investigations of McCollum and of Cristiani, it is evident that not only our drinking water but also our daily food may be the source of fluorin, the mechanism of its action indicating a disturbance of the calcium metabolism.

The amount of fluorin which produces mottling of enamel in the child causes no recognized abnormality in the adult. It seems logical to assume that other detrimental effects may be produced, but that they have not yet been correlated with this factor. Fortunately, a liberal amount of calcium in the diet and exposure to ultraviolet rays tend to overcome the evil effects of fluorin.[5]

In view of the definite possibility of chronic fluorid intoxication, a note of warning is in order. No dental product, such as a dentifrice, cleaning preparation, bleach for the teeth or mouth-wash, which might be used daily over long periods, should contain ammonium fluorid or any other reactive fluorid product. Ammonium fluorid is sometimes used in the dental office as a means of rapidly whitening a patient's teeth. Such treatment used occasionally, say once or twice a year, may do no harm to the patient; but if used frequently, it would be potentially harmful. When dentists mix ammonium fluorid with mild abrasives or pastes, which may be applied at frequent intervals to different patients with a rapidly revolving brush, they submit themselves to possibilities of chronic intoxication. Continuous swallowing or inhalation of fluorid in dust or particulate form should be avoided, since the moist surfaces of the respiratory and alimentary tracts readily absorb the fluorid. Thus, the connotations of both acute and chronic intoxication with fluorid are far-reaching and important. The close correlation of experimental and clinical results on fluorid testifies to the increasing value of dental research in matters of public health and of professional problems.

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3. Smith, M. C.; Lantz, E. M., and Smith, H. V.; Tech. Bull. No. 32, Univ. Ariz. Coll. Ag., June 10, 1931.

4. Smith, M. C.: Science, 74 (Supp.): 14, 1931.

5. Chaneles, J.: Cómpt. rend. soc. de biol., 102:860 (Dec. 13) 1929.

SEDORMID—NOT ACCEPTABLE FOR A. D. R.

In the latter part of 1930, there came to the Council from dentists inquiries on Sedormid, stated to be a new product put out by Hoffman-LaRoche, Inc., Nutley, N. J. These inquiries, together with the advertising literature, were submitted to a referee of the Council, who recommended that Sedormid be held unacceptable for A.D.R. and the report be adopted by the Council.

This report, incorporated in the report below, was sent to the Hoffman-LaRoche Company. In reply, they stated that as they had not formally submitted the product to the Council, they could not see how their product could be in conflict with the rules of the Council.

In reply, the firm was advised that the Council was willing to wait a reasonable length of time in order to be informed of the further plans of the manufacturer in marketing the product to the dental profession; and that the Council would consider the product if the manufacturer found it desirable to present acceptable and critical evidence of the usefulness of the product, but that no manufacturer or promoter can indefinitely forestall or prevent the Council from taking the initiative in matters that the Council deems to be in the best interests of the profession and the welfare of the public. The referee did not desire to discuss the statement of business ethics of the manufacturer sent in reply to some of the conditions of the referee, since he was content with what has been said about Allonal, an unacceptable product of the same manufacturer, and described in a publication of the American Medical Association (*J.A.M.A.*, June 12, 1926, p. 1853).

As almost one year has passed since the report of the Council was sent to the firm, and exploitation has continued to dentists and to the medical profession, the Council again took up consideration of the product, and has authorized publication of the following report.

SAMUEL M. GORDON, *Secretary.*

In October, 1930, the Council received a form letter on the stationery of Hoffman-LaRoche, Inc., Nutley, N. J., advising dentists to try Sedormid. This form letter stated that enthusiastic reports had been received from dentists in three cities on the actions of Sedormid in the dental clinic. Sedormid was described as a preparation which would fill "the rather wide gap in your medical armamentarium between the bromids and the powerful barbiturates," and the statement made that trial packages were being sent.

Previously, reports had appeared in drug journals.

A communication was addressed to the firm requesting their evidence on the usefulness of the product in dental practice. In reply, the firm forwarded a cursory statement of the chemistry and toxicology of the product, and a number of comments from dentists on the therapeutic value of Sedormid in dentistry. These testimonials, several of which are quoted, could not be considered as adequate evidence:

Tried with excellent results. Interested, will try further.

Has used Sedormid with very good results. He first gave some to his wife who is of a somewhat nervous disposition and the results were so pleasing he has started to use it in his practice.

States that Sedormid has certainly helped him a great deal in his work with nervous patients and that he will not be without it.

Has used Sedormid with very good results.

These testimonials, which were chosen at random from those submitted by the firm, could not convince the referee of the usefulness of the product in dental practice until more adequate evidence based on results in a large number of patients, carefully observed, had been sent to the Council.

Advertising issued in 1930 and 1931 states:

Sedormid is an unusually safe sedative and hypnotic, producing its therapeutic effect in doses far below the possibility of toxicosis. It is very quickly and completely oxidized in the body and is rapidly eliminated, so that even after large doses only traces are found in the urine the day after administration. Cumulative effects are, therefore, entirely absent. Sedormid does not affect the heart rate or blood-pressure, nor does it exert any harmful effect upon respiration. During elimination there is no deleterious effect upon kidney function or structure.

In advertising to dentists, it was stated to be indicated in:

Nervous excitations and their sequelae, nervous fatigue, neurasthenia, psychasthenia and irritability, excitability and sleeplessness due to apprehension, distraction, cardiac neuroses, arrhythmias and valvular insufficiencies, psychopathic excitation and insomnias of anxiety neuroses, hysteria, dementia senilis and melancholia, nervous disturbances of menopause and menstruation, hyperthyroidism and dysovarism, salt deprivation, neuroses in diabetic and hypertensive patients, peripheral and coronary arteriosclerosis.

This is obviously a group of conditions which come outside the range of dental practice, and which offer a fruitful field for indiscriminate and self-medication, whether a preparation is advertised directly or indirectly to the public.

A careful review of the advertising literature on, and claims for, Sedormid, by the referee clearly indicated that the product was being marketed in conflict with certain rules of the Council. For instance, tests for identification of the product are not given, and advertising of this hypnotic to the public through the dental profession appears to be underway, for "steps have been taken which will insure an initial 100 per cent distribution this month in every drug store in the country, immediately following which free trial supplies of Sedormid will be sent to every practicing physician and dentist as the initial move in creating a country-wide demand." (*Drug Bulletin,* September, 1930, p. 41.) The name is therapeutically suggestive and undesirable, and unwarranted therapeutic claims are made to dentists.

Unless these conflicts were removed, the Council could not consider the product favorably. One further reason which demanded consideration on the part of the Council was that Sedormid is another member of the vast army of hypnotics of a type which requires no further multiplication.

On the other hand, the Council being desirous of maintaining a constructive attitude, if the manufacturer were to agree to comply with the rules of the Council, which would be essentially to supply further desirable data and cease premature commercial exploitation of the product, the referee would be ready to consider the product for possible acceptance for A.D.R. At the same time, the referee offered certain suggestions and comments for the consideration of the firm.

The suggestions of the referee related to tests for the identity and purity of the product as it is new in the drug armamentarium; and more complete data on the fate of Sedormid in the body and on the actions of the product in dental practice since there is very little in the literature concerning the fate of the product in the body and in dental practice. The absence of these data caused the referee to conclude that the product was being offered to dentists prematurely.

The stated indications for use are far too sweeping and do not justify advertising of the product to dentists, and consequently to the public. The great variety of ills and disorders mentioned do not come within the scope of dental therapeutics. In this type of indirect advertising to the public, there exists the ideal method of

promoting self-medication, a practice which is directly opposed to safe and rational therapeutics, the support of which is the primary function of the Council. If the product is to have favorable consideration, the manufacturer should be required to submit further evidence of indications for use consistent with the highest ideals of dental therapeutics. The referee further believes that a less therapeutically suggestive name, indicative of the chemical composition of the product, might be coined.

The firm, in a reply which could not lead to a revision of the Council's statement, held that it failed to see how the product could have come in conflict with the rules of the Council, as "no brief has been prepared by us discussing every detail of the chemistry and pharmacology of Sedormid as well as the clinical action of the drug in the manner in which it is customary to prepare such complete briefs. . . ."

The Council could not seriously consider this argument since it may take the initiative in considering a product when it is marketed to the dental profession, whether or not such product has been submitted by the manufacturer.

The firm further stated that if they should eventually decide to submit Sedormid for the consideration of the Council on Dental Therapeutics, they would make a reply to the report adopted by the Council, at which time they would submit all data on Sedormid which are available from laboratory reports and from the medical literature.

They offered emphatic objection to the statement of the referee that the product would eventually go directly to the public; which calls for no serious argument with those acquainted with the marketing of proprietary remedies. Many of these are not advertised directly to the public, yet large quantities are sold over the druggist's counter without prescriptions from dentists and physicians.

Over a year has passed, and the information requested by the Council has not been submitted by the firm, although exploitation of the product has continued. In the meantime reports have come to the referee of mental excitation and other disturbing symptoms arising after the administration of Sedormid by mouth; and while it is impossible to assert that these untoward symptoms were due to the administration of Sedormid, both patients improved after its discontinuance.[1]

As the firm had not submitted the information requested almost a year ago in the report of the Council, the referee again took up consideration of the product and recommended that the foregoing report be published for the information of the dental profession.

In view of the foregoing, the Council declares Sedormid unacceptable for A.D.R., because it is a compound marketed prematurely with unwarranted therapeutic claims (Rule 6), under a therapeutically suggestive name (Rule 8), and tests for the identity and purity of the product have not been furnished (Rule 2).

The Council stands ready to consider Sedormid for A.D.R. when the objections listed in this report have been removed.

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1. Since the adoption of this report, a discussion of Sedormid has been published in the Journal of the American Medical Association (98:1104 [March 26] 1932) under the title, "The Use of Barbital Compounds."

DENTINOL—NOT ACCEPTABLE FOR A. D. R.

The Council has authorized publication of the following report.

SAMUEL M. GORDON, *Secretary.*

Dentinol, according to the Dentinol and Pyrozide Company, New York City, is composed as follows: cresol (refined), 30 parts; oil of eucalyptus, 3 parts; oil of birch, 13 parts; oil of sassafras, 13 parts; camphor (gum), 10 parts; oil of capsicum, 1 part; oil of turpentine, 5 parts; alcohol, 20 parts; ether, 5 parts.

Advertising matter gives a qualitative statement of composition; the label states only the presence of alcohol 20 per cent and ether 5 per cent, mentioned no doubt in accordance with the requirements of the Food and Drugs Act of 1906. The presence of alcohol in a medicinal preparation must, in accordance with the law, be mentioned. The preparation represents a shotgun mixture and is, therefore, unscientific.

It is said to be

> Specifically designed to destroy the mixed microorganisms, always present in pyorrhea and other oral infections, without injury to the oral tissues.
>
> The combination of ingredients used in producing Dentinol, makes it the ideal germicide and healing agent for dental purposes.

Evidence in support of these claims is not available. Furthermore, this gives an erroneous impression, for the "successful" treatment of pyorrhea depends in the last analysis on the intelligent application of a number of therapeutic measures, none of which in themselves are complete.

The Council declares Dentinol unacceptable for Accepted Dental Remedies because a quantitative statement of composition does not appear on the label (Rule 1); because unwarranted and misleading therapeutic claims are made (Rule 6), and because it represents an unscientific mixture (Rule 10), and thus is inimical to the best interests of the profession and the public.

PYROZIDE—NOT ACCEPTABLE FOR A. D. R.

The Council has authorized the publication of the following report.

SAMUEL M. GORDON, *Secretary.*

Pyrozide is said to be a sterilized dentifrice "containing Dentinol and other medicinal agents." According to the Dentinol and Pyrozide Company, New York, it is made up as follows: white oak bark (powdered), 10 parts; red cinchona bark (powdered), 15 parts; elm bark (powdered), 10 parts; white precipitated chalk, 60 parts; cresol (refined), 1.5 parts; oil of eucalyptus, 0.15 part; oil of birch, 0.65 part; oil of sassafras, 0.65 part; camphor (gum), 0.5 part; oil of capsicum, 0.05 part; oil of turpentine, 0.25 part; alcohol, 1 part, and ether, 0.25 part.

The tree barks which make up 35 per cent were formerly included in the old materia medica primarily in the preparation of astringent mixtures, antimalarials and demulcents, but their use has been largely replaced by more definite drugs of the new materia medica. Their use in a dentifrice designed for therapeutic use is apparently irrational. The provisions for the acceptance of dentifrices and the

specifications are extremely liberal as regards the composition of this class of products. Hence, acceptance depends in the last analysis on claims made for the preparation. Statements appearing in magazine advertising are misleading and unwarranted in that it is inferred that the use of this powder will prevent pyorrhea:

BLEEDING GUMS, RECEDING GUMS, TENDER GUMS, WATCH CLOSELY FOR THESE SIGNS OF PYORRHEA. Pyrozide Powder was formulated especially for stimulating and hardening gums. The wide use of Pyrozide for gum protection is largely the result of dentists' prescriptions. (*American Magazine*, September, 1929.)

The council assumes the position that the mention of disease symptoms in connection with the advertising of a product implies that such product is beneficial to such diseases, and is therefore misleading unless the claims are supported by adequate evidence.

Statements such as the following in advertising sent to dentists are misleading and unwarranted:

It (Pyrozide) is medicated with Dentinol to give needed stimulation to the gums, while the teeth are being brushed.

The ideal dentifrice functions in two ways. It must stimulate blood circulation in the gums so that their firmness shall be preserved.

It removes mucoid deposits (film) which harden and form tartar.

It reduces gum irritation.

It stimulates blood circulation in the gums.

It keeps gums firm.

All of which are definite statements and should be supported by definite evidence, which is not available.

The Council declares Pyrozide Powder not acceptable for Accepted Dental Remedies because it is a dentifrice which is advertised in a therapeutically suggestive manner and thus runs contrary to the provisions of the Council for the admittance of dentifrices to the list of accepted dental remedies, and because it is compounded with Dentinol, an unnecessarily complex "shotgun" preparation, which is not acceptable.

SODIBOR—NOT ACCEPTABLE FOR A. D. R.

The Council has authorized the publication of the following report.

SAMUEL M. GORDON, *Secretary*.

Sodibor, according to the Sodibor Laboratories, White Plains, N. Y., contains 98 per cent of pure sodium perborate, flavored with a mixture containing 1 per cent of phenol, together with oil of clove and of peppermint. A small quantity of phenolphthalein is incorporated to establish its alkaline reaction. A statement of composition does not appear on the label.

The preparation is therefore sodium perborate irrationally modified by the addition of phenol. No evidence was presented that Sodibor possesses any material advantages over noncompetitive brands of sodium perborate, which are readily available under definite standards of purity. In view of the statement of composition, the Council cannot recognize the firm's right to a proprietary name for such a

preparation as Sodibor, as it represents an unessential modification of a well-known official drug.

The advertising is objectionable in that it carries recommendations for the treatment and medication of pyorrhea, aching gums, Vincent's infection, bleeding gums and halitosis, all of which require careful diagnosis and treatment under competent direction. No evidence was submitted to support the claim that Sodibor achieved a solution of sodium perborate with augmented advantages. It is not stated what the augmented advantages are.

The Council holds Sodibor not acceptable for A. D. R. because it is an unessential modification of a well-known official drug marketed under a nondescriptive name in such a manner as to induce self-treatment for serious dental conditions (Rule 3); because a statement of the phenol content does not appear on the label (Rule 7), and the firm is not entitled to a proprietary name for an unessential modification of sodium perborate (Rule 8).

KRAMER'S ORIGINAL CHARCOAL DENTAL CREAM—NOT ACCEPTABLE FOR A. D. R.

The Council has authorized publication of the following report.

SAMUEL M. GORDON, *Secretary.*

Kramer's Original Charcoal Dental Cream, according to Modern Products, Inc., Jackson, Mich., is made up as follows:

Neutral Soap (Specially prepared for tooth paste)	7 per cent
Glycerine, C.P.	40 per cent
Calcium carbonate, Ppt.	40 per cent
Magnesia carbonate	5 per cent
Sod. salicylate	3 per cent
Sod. benzoate	3 per cent
Saccharin	q.s.
Oils of peppermint, cloves, cinnamon and anise for flavoring.	
Distilled water, q.s.	100 per cent
Charcoal, best quality bolted willow twig, 1 pound to 100 pound batch.	

The tooth paste thus contains approximately 1 per cent of charcoal. The use of charcoal in a tooth paste was introduced some years ago because of the property of charcoal for absorbing gases, coloring matter, etc. That charcoal in a dentifrice absorbs mouth odors under conditions of dentifricial use remains to be experimentally verified. Clinical experiences are recorded in which the particles of charcoal became inbedded in the gum tissue and produced a bluish line near the margin, which is removable only by surgical means. No evidence was presented to the Council to show that Kramer's Original Charcoal Dental Cream is free from these objections.

Unless evidence to cause a revision of the foregoing is submitted, the Council cannot admit Kramer's Original Charcoal Dental Cream to A. D. R., because it is

a dentifrice intended for daily use that contains charcoal, a potentially harmful substance.

Correction: On page 327, February, 1932, issue of THE JOURNAL, under Thromboplastin Local-Squibb, "It is claimed that no loss of potency could be detected in unopened thromboplastin-Squibb more than three days old," should read: "It is claimed that no loss of potency could be detected in unopened thromboplastin-Squibb more than three years old."

BUREAU OF CHEMISTRY

DR. McARTHUR'S DENTAL MASSAGE AND ORA HYGIENE

The following is a report of the A. D. A. Bureau of Chemistry.

SAMUEL M. GORDON, *Chief.*

INQUIRIES have been received by the A. D. A. Bureau of Chemistry concerning Dr. McArthur's Dental Massage, which is stated on the principal label to be "Endorsed and sponsored by the Oral Research Laboratories, Detroit, U. S. A."

A dentist in Wyandotte, Mich., writes:

We are interested in having a preparation, "Dr. McArthur's Dental Massage" investigated. This product is commercialized by a Detroit advertising dentist with rather flowery claims as to its effectiveness.

A dentist in Adrian, Mich., writes:

I am a member of the A. D. A. Have been in general practice here near Detroit for some years. The advertisers in Detroit make regular use of the radio. A Dr. McArthur has been advertising his dental massage cream and its wonderful power to cure all gum diseases, etc. I am wondering what would be the cost of analysis by your Dept. of Chemistry.

Correspondents were informed that such an examination might be undertaken provided the product was of general interest to the dental profession and the public, and the public interest might be served by such examination. If samples were secured and their source vouched for, examination would be undertaken. Correspondents were further informed that this work was supported by the American Dental Association in order to give unbiased information to the profession and to the public on dental articles, and no direct charge was made. In reply, a correspondent wrote:

We sent a boy to Dr. McArthur's office to purchase a tube of the dental massage and he returned with a bottle of "Ora Hygiene," a red liquid. The boy remonstrated, but they deftly got his dollar and sent him out without the product he was instructed to purchase. We then obtained the tube of massage at one of the numerous drug stores at which it is sold and are forwarding same to you.

The exorbitant claims for this Massage are made over the Detroit News radio station, WWJ, at 12:30 p. m. and again at 6:15 p. m. daily.

The request of the Bureau for transcriptions of the radio continuities ascribed to Dr. McArthur's account was not fulfilled. Our correspondent writes:

There seems to be a reluctance to issue these copies, perhaps because of the realization of their offensiveness to organized dentistry.

In writing further to the Bureau on the promotion of these products, our correspondent states:

Further, Dr. McArthur's offices have expressed a caginess about our obtaining the two bottles of Ora Hygiene and three tubes of Dental Massage you requested, as evidenced by the fact that when my office girl was sent to the main office in Detroit to get the three tubes and two bottles of preparation, she was questioned by three different men and finally given one tube and one bottle only, for which they refused to issue a receipt. A second tube and bottle were obtained in the Wyandotte branch office by a second solicitor and he did

succeed in getting a receipt. I shall forward to you all samples, receipts and information in a few days. . . ."

An "Official Entry Certificate" for the $600 name contest for Dr. McArthur's Dental Massage was sent. This relates a premium scheme to obtain a new name for Dr. McArthur's Dental Massage. The prizes vary according to whether the entry certificate is accompanied by the printed front of a carton of Dr. McArthur's Dental Massage and a receipt for dental work done in any of Dr. McArthur's offices; the entry certificate is accompanied by the printed front of a carton of Dr. McArthur's Dental Massage, or the entry certificate alone is used. The highest prize is limited to those who present a receipt for work done in Dr. McArthur's offices. We have not yet been informed of the winner of the contest or the new name for Dr. McArthur's Dental Massage.

The following is given as to "WHY WE WANT A NEW NAME."

In addition to being wonderful corrective agent for sore, inflamed and diseased gums, Dr. McArthur's Dental Massage also is a remarkable preparation for daily use as a tooth paste. We feel that the present name does not cover this function. The new name *must* [italics in original] suggest its use as tooth paste as well as a dental massage of outstanding merit.

It is only fair to state that employes of the McArthur Dental Massage Company and their families are debarred from the contest.

To help contestants, the following story is told:

Dr. McArthur's Dental Massage is a combined gum treatment and super tooth paste. The winning name *must* [emphasis in the original] suggest these combined qualities. Before being placed on the market, the beneficial results of Dr. McArthur's Dental Massage were studied in more than 1,000 cases. Hundreds of letters testify to the unusual advantage of this product in relieving gum ailments, stopping gum bleeding, correcting gum and mouth soreness and in tightening and hardening flabby gums.

The actual cost of ingredients in Dr. McArthur's Dental Massage is twice the cost of those in many of the popular brands of tooth paste.

Dr. McArthur's Dental Massage cleans the teeth by a new and revolutionary scientific process. *It has absolutely no abrasive.* [Italics ours.] It removes the film on the teeth by dissolving it instead of scraping it off.

. . . Dr. McArthur's Dental Massage is remarkably beneficial in relieving the irritation in infants' gums during the teething period. It is also effective in soothing the gums for those who wear artificial teeth and when placed in the sockets after extraction it aids and accelerates the healing process.

Finally, the contestant is told:

Dr. McArthur's Dental Massage contains ingredients which purify the mouth and breath. **It is an antiseptic tooth paste and gum massage.** [Boldface type in the original.]

The judges are said to be: Leo J. Fitzpatrick, manager of radio station WJR, W. W. Gedge, manager of radio station WMBC, and "Ty" Tyson, assistant manager of radio station WWJ. It might be logical to question the qualifications of these gentlemen to judge the functions of a tooth paste on scientific grounds.

Dr. McArthur is also said to give dental advice over the radio.

It is asserted that Dr. McArthur's Dental Massage is endorsed and sponsored by the Oral Research Laboratory, Detroit, Mich. Who or what the Oral Research Laboratory is, apparently even those in Dr. McArthur's office do not know.

We are informed that Dr. Clarence McArthur incorporated the Professional Research Laboratories, Inc., at the same address as his Detroit office.

In view of the definition of the Council on Dental Therapeutics, based on well-considered observations, that the functions of a tooth paste are strictly limited to aiding the toothbrush in keeping the

surfaces of teeth clean, the claim of the "unusual advantage of this product in relieving gum ailments, stopping bleeding gums, correcting gum and mouth soreness and in tightening and hardening flabby gums" needs strong corroborative, unbiased evidence before it can be seriously considered.

The circular accompanying the tube states that Dr. McArthur's Dental Massage is "especially indicated in all stages of pyorrhea" and "is the result of thirty years' experience in the field of dentistry." It is recommended as an outstanding meritorious product for all irritations and inflammation of the oral cavity, and it is stated to be scientifically manufactured according to Dr. McArthur's own formula.

According to the circular around the tube, all one needs to do for pyorrhea is to use "a liberal amount of dental massage cream either with the finger or very soft brush at least twice daily." It is also recommended "after extraction, for teething babies, for artificial dentures." "Dr. McArthur's Massage is a triple action preparation," whatever that may mean.

According to our records, Dr. Clarence M. McArthur is a graduate of the Detroit College of Medicine, Department of Dental Surgery, Detroit, class of 1900. He is not a member of his local dental society and thus is not entitled to membership in the American Dental Association.

The specimen of Ora Hygiene stated to be purchased from Dr. McArthur's Wyandotte office is said on the label to be a mouth wash which "really prevents decay," and "is antiseptic, astringent, deodorizing, cleansing, neutralizing the acid." The label recommends "Instead of water, follow up your toothbrush and dentifrice by rinsing the mouth with Ora Hygiene full strength."

It is stated to be compounded by the Ora Hygiene Products Corporation, Detroit and Chicago, U. S. A. No such listing appears in the current telephone directory of either Chicago or Detroit.

In order to determine the composition of Dr. McArthur's Dental Massage and Ora Hygiene, the products were examined in the A. D. A. Bureau of Chemistry. The chemist's reports follow:

DR. MCARTHUR'S DENTAL MASSAGE

One original package of Dr. McArthur's Dental Massage (The Oral Research Laboratories, Detroit) was received for examination.

The package consisted of a tube enclosed in a carton, accompanied by a circular.

The following appeared on the label:

Dr. McArthur's Dental Massage. Endorsed and sponsored by the Oral Research Laboratories, Detroit, U. S. A.

The tube contained approximately 97 gm. (3⅛ ounces) of a pink paste possessing a sweet, soapy and cooling taste and a predominating odor of cinnamon.

Qualitative tests indicated the presence of calcium, sulphate, sugar, glycerin and water. Sodium, iron, phosphate, carbonate, borate, salicyl compounds, fatty acids and gums were indicated in small amounts. Menthol and oil of cinnamon were indicated by odor. Other metals, acohol, alkaloids, starch and starch-bearing materials (orris root), chlorids and iodin-liberating compounds were not found. An aqueous infusion reacted slightly alkaline to litmus.

Quantitative examination yielded the following:

Loss in weight (100 C.).....20.7 per cent
Loss in weight (over H_2SO_4)...17.8 per cent
Ash (600 C.).....55.4 per cent
Calcium (Ca^{++}) .....16.2 per cent

Sulphate (SO_4^{--})	38.9 per cent
Borate (B_2O_3)	0.1 per cent
Glycerin	8.7 per cent
Sucrose	7.0 per cent
Ether extract*	2.7 per cent
Salicylic acid	0.1 per cent

*Qualitative examination indicated a relatively large amount of fatty acids, together with small amounts of salicylic acid and menthol-like and cinnamon-like substances.

From the foregoing, it may be concluded that Dr. McArthur's Dental Massage is calcium sulphate compounded into paste form by the use of glycerin, gums and water, and flavored and sweetened with essential oils and sugar. Salicyl compounds and soap were found in small amounts.

ORA HYGIENE

One original package of Ora Hygiene (The Ora Hygiene Products Corp., Chicago and Detroit, U. S. A.) was received for examination.

The following appeared on the label:

Ora Hygiene. The Follow-Up System. A mouth wash which really prevents decay. Antiseptic, astringent, deodorizing, cleansing, neutralizes the Acid.

Acid causes 98% of the cavities in the teeth. This solution neutralizes the acid between the teeth at gum line and in the small fissures of the Molars and Bicuspids not reached by any brush, paste or powder.

Directions:—Instead of water, follow up your toothbrush and dentifrice by rinsing mouth with Ora Hygiene (full strength).

Compounded by The Ora Hygiene Products Corp., Chicago, Detroit, U. S. A.

The bottle contained approximately 430 c.c. (14½ fluid ounces) of a pink liquid which was practically odorless and tasteless and possessed a faint alkaline reaction to litmus. The specific gravity was 1.000 at 20 C., and the refractive index was 1.335 at 20 C.

Qualitative tests indicated the presence of sodium, chlorid, borate and salicylate. Formaldehyd and heavy metals were not found. Distillation indicated that the liquid was essentially water.

Quantitative examination yielded the following:

Total residue (100 C.)..0.209 gm. per 100 c.c.
Ash (600 C.).....0.162 gm. per 100 c.c.

On account of the small amount of solid material, no other quantitative determinations were made.

From the foregoing, it may be concluded that Ora Hygiene is essentially water modified by small amounts of salt, borax, sodium salicylate and coloring matter.

According to the chemist's report, the essential composition of Dr. McArthur's Dental Massage is calcium sulphate, glycerin, sugar, a small amount of soap and flavoring agents and water.

Ora Hygiene, which is recommended in place of water, was found to be essentially water containing approximately two parts in a thousand of salt and borax, colored and flavored.

In view of the foregoing, is it not logical to ask how any paste composed essentially of calcium sulphate becomes curative for pyorrhea, for teething or for irritation? Dentists appreciate that those diseases coming under the term pyorrhea require competent attention on the basis of the individual, and successful treatment depends on careful attention to operative detail. One may properly question how a toothpaste of the essential composition above "removes the film on the teeth by dissolving it instead of scraping it off."

The claim that Ora Hygiene is a mouth wash which really prevents decay, "antiseptic, deodorizing, astringent, cleansing, neutralizes acids" is unwarranted in the light of the chemist's analysis.

BUREAU OF PUBLIC RELATIONS

NEED OF COOPERATION BETWEEN PEDIATRICIAN AND DENTIST*

By EDWARD CLAY MITCHELL, M.D., F.A.A.P., Memphis, Tenn.

INCREASINGLY, prevention rather than cure is the primary objective of dentist and physician. In the whole program of oral prophylaxis, the earliest measures which may be employed to safeguard the developing oral structures are normally within the province of the obstetrician and the pediatrician. There can be no question that these specialists are all too frequently passing on to the dentist for correction their own mistakes of commission and omission. Notoriously, pediatricians have been neglectful of their obligation and their opportunity in this important matter. They have been so much concerned with whoopingcough, measles and various other complaints that they have failed to see the teeth.

It is my purpose in this paper to analyze, if possible, the fundamental factors in sound and enduring tooth structure. I do not mean to say that I am prepared to define a procedure which will guarantee perfect or even good teeth. Obviously, much of the problem of oral health remains for solution; but I am convinced from facts and experience already available that solution is to be found very largely in a more accurate appreciation of the tooth as a living part of the whole organism and a more exact evaluation of its dependence on nutritional factors.

As I have suggested, the oral conditions which come to the dentist's attention are forecast, for the most part, during the period when obstetrician and pediatrician are responsible for the welfare of the patient. Simkins[1] has given us the chronology of tooth differentiation, as shown in the accompanying table. From this table, it appears that calcification begins in the 140th day of fetal life. During the subsequent fetal period and the first few years of childhood, there will be formed good, resistant teeth, or poor ones, easily broken down by outside agencies.

Since the researches of Avon and Lebauer,[2] we have known that teeth are composed of enamel, dentin and cementum, the last being identical with bone in structure and chemical composition. Teeth and bone alike are chiefly a combination of calcium, phosphorus and protein.

I have been using the chart shown in Figure 1 to explain to mothers in a gen-

*From the Department of Pediatrics, University of Tennessee.

*Read before the Section on Mouth Hygiene and Preventive Dentistry at the Seventy-Third Annual Session of the American Dental Association, Memphis, Tenn., Oct. 20, 1932.

1. Simkins, C. S.: Textbook of Human Embryology, Philadelphia: F. A. Davis Company, 1931.

2. Avon and Lebauer in: Scott, G. D.: Tooth Decay and Balanced Metabolism in Infancy and Childhood, M. J. & Rec., 125:186 (Feb.) 1927.

CHRONOLOGY OF TOOTH DIFFERENTIATION

Age	Length (Mm.)	Tooth Differentiation
30 days	12-15	Epithelium thickens to form the dental shelf
48 days	17	Labial furrow and dental shelf separated; lamina shallow
54 days	25	Buds arise on lateral sides of lamina, 4 above, 4 below, for the incisors 1 and 2
70 days	32	Eight buds in each jaw; incisors, cuspid and first bicuspid; enamel organs indented
80 days	40	Second bicuspid added; ten papillae now present
98 days	115	Stellate reticulum arises in enamel organ; lamina extends backward; papilla for first milk molar arises
119 days	180	Epithelial strand thins out; lamina fenestrates above incisors; papilla for first permanent molar arises
140 days	240	Deciduous incisors calcify; first permanent molar disconnects from lamina
168 days	300	Cuspids and bicuspids calcify; enamel organ and papillae for first and second permanent incisors form; papilla for permanent cuspid arises, and enamel organ of first permanent molar
203 days	360	Cusps of deciduous molar calcified; bud for first permanent bicuspid arises from shelf.
231 days	400	Enamel organ of second permanent bicuspid arises; cusps of deciduous molar united
Full term		Deciduous incisors calcified from 4 to 5 mm.; cuspids and molars calcified for 2.5 mm.; cusps on first permanent molar calcified
4 months		Deciduous, incisors, cuspid, increased calcification; permanent first molar calcified; enamel organ for second arises
6 months		Deciduous central incisor erupts; lateral shows 5 mm. calcified; cuspid calcified for 5 mm. of crown; permanent incisors form roots; papillae for first molar
12 months		Deciduous lateral incisor erupting; cuspid calcified; first bicuspid erupts; central incisor erupted
16 months		Deciduous bicuspid erupts
20 months		Deciduous second bicuspid calcified from 4 to 5 mm.
24 months		Deciduous second bicuspid erupted; all twenty teeth erupted but roots not formed; permanent second molar has 4 cusps calcified
3 years		Deciduous incisors fully calcified; first and second molars calcified; permanent incisors partly calcified, roots formed; crown of the cuspid calcified; bicuspids have cusps united; crown calcified on second molar; papilla and enamel organ of third molar forming
5 years		Papilla of third molar fully formed
7 years		Deciduous central incisors shed; lateral absorbing
8 years		Permanent central incisors erupted; lateral comes up; first molar erupted
9 years		Deciduous molar absorbs; permanent first bicuspid erupted
11 years		

eral way something of the physiology and microscopic anatomy of the tooth. The pulp, blood vessels and dentin are represented. The chart undertakes to show also that caries, or decay, begins in the dentin, the enamel, or hard part, being affected later. Furthermore, the tooth is shown not merely as a peg of ivory inserted in the mouth, but as a living organ. Until fairly recently, the tooth has not

been considered as a vital, metabolizing tissue which should be fed and whose requirements should be constantly included in the general nutritional scheme.

One of the most notable contributions made during the present century to the science of nutrition has been the discovery of the probable etiology of rickets, as well as effective preventive and therapeutic measures for this condition. In rickets we have a pathologic metabolism of the bony tissues directly traceable to malnutrition. While active rickets occurs largely during the first two or three years of life, there is still considerable controversy as to the occurrence of fetal rickets. It is now universally admitted that a strong straight bone which survives this period remains strong and straight, and I am prepared to assert that teeth which pass safe and sound through this same period carry a normal expectancy of good health. In a recent discussion of this matter, an orthopedic surgeon who has many cases of bad rachitic deformities informed me that in nearly all instances the teeth were bad. Unquestionably, heredity has some influence on the teeth of the child; but it would seem that the importance of heredity has been strongly overrated. While delayed dentition may be seen in many members of a family, good teeth in all members of a family are probably due to the same healthful environment, correct diet and proper care.

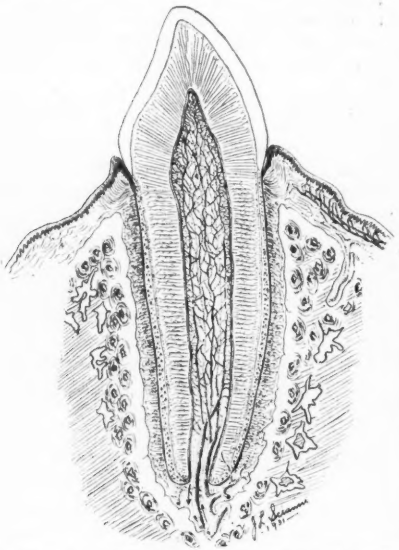

Fig. 1.—Drawing of cross-section of tooth and gum for purpose of demonstrating to layman that tooth is living structure and requires nourishment.

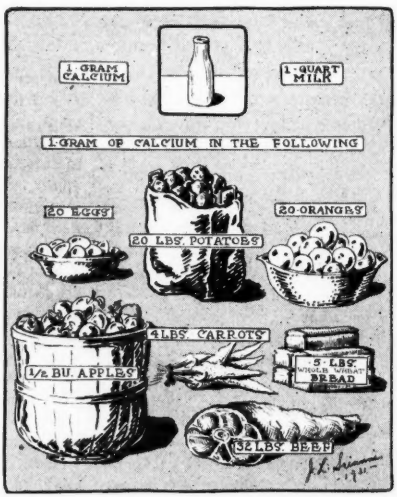

Fig. 2.—Relative calcium content of various common foods.

One of the most convincing demonstrations of the effect of environment on tooth structure is supplied by the experiments of Mellanby[3] on dogs. Of two groups of pregnant dogs, one group was given a diet rich in fat soluble vitamins A and D, while the other group received

3. Mellanby, May; Pattison, C. L., and Proud, J. W.: Effect of Diet on Development and Extension of Caries in Teeth of Children, Brit. M. J., 11:354 (Aug.) 1924.

a diet deficient in these substances. The puppies of the mothers on the vitamin-rich diet had well calcified deciduous teeth; whereas, the puppies of the mothers on the deficient diet had defectively calcified deciduous teeth. After weaning, the puppies were paired, a pair consisting of one puppy from each of the two groups. All pairs received the same basic diet. Different pairs received in addition various foods such as cod-liver oil, olive oil and oatmeal. Subsequent defects in structure of the permanent teeth of any pair which were fed a diet deficient in vitamin D were found to begin earlier in the puppy whose mother had received the deficient diet during pregnancy.

While objection has been made on account of the marked difference between the teeth of human infants and the teeth of puppies, it seems to me that these findings by Mellanby are of extreme value. It has been suggested that if two groups of 500 pregnant women each could be taken for such an experiment, one group receiving a proper diet and the other group receiving a deficient diet, comparison over a period of years of the teeth of the offspring of the respective groups would justify a more positive conclusion. Quite apart from the impracticability of such a study as this, it is obviously improper to subject the human animal to the hazard of an experiment the results of which may be reasonably anticipated from observations on some other subject. In the light of Mellanby's experiments and clinical observations, we cannot, I believe, doubt that the diet of the human mother certainly has a marked effect on tooth formation and preservation in the child, not only on the deciduous teeth but also on the permanent dentition.

Pediatrics is, I think, correctly defined as that branch of medicine which treats of the growth, nutrition and development of the infant and the child, with a consideration of the deformities and diseases coincident with this period. I try to impress on my students that the science of pediatrics should be confined largely to feeding, general management and prevention of disease during childhood; whereas, the treatment of diseases and correction of deformities during this time of life properly constitute *baby medicine* rather than pediatrics. If the medical student will get this concept firmly grounded in his mind and realize his proper function when be becomes a pediatrician, we shall have a stronger and healthier race of children. I dwell on this proposition because no infant who is properly nourished should have bad teeth.

I have made the general assertion that feeding the teeth is the most essential factor in the development of perfect teeth. I have asserted also that the tooth improves or suffers with general body nutrition and that those conditions which influence, particularly, development of bone will likewise affect the formation of the tooth. I have especially cited probable effects of the vitamins on the expectant mother and her offspring; and here I wish to insert a word of caution: Unfortunately, there has been a tendency to consider vitamins exclusively although these agencies are only one part of a well balanced diet. The child must be properly nourished quite apart from any consideration of the accessory foodstuffs. He must receive sufficient food of all categories, and all factors of growth must be included in the diet if some phase of metabolism is not to suffer. When the child's general nutrition is imperfect, certainly teeth and bone will not show perfect development.

I think it would not be amiss to give in detail here an outline of those food fac-

tors and conditions which affect growth and nutrition in general. This outline has been made as simple as possible so that it may be explained to mothers and others interested in child welfare.

FOODS AND CONDITIONS WHICH INFLUENCE GROWTH AND DEVELOPMENT

(A) Food Elements:

1. Protein.
   (*a*) This element is essential to life.
   (*b*) The child requires 2½ times the protein quota of the adult, because the child must build new tissue as well as replenish old.
   (*c*) Foods which contain protein are chiefly milk, eggs and meat.
   (*d*) Pure protein contains little vitamin.

2. Fat.
   (*a*) This element furnishes heat and energy to the body.
   (*b*) It contains some of the essential vitamins.
   (*c*) It seems to have an especial function in the development of bone marrow and nerve tissue.
   (*d*) The deprivation of fat produces various atrophic changes; also causes certain forms of a vitaminosis.
   (*e*) It is found principally in animal fat, cream, butter and vegetable oils.
   (*f*) Heat destroys some of the vitamin value.
   (*g*) The ultraviolet ray may increase the vitamin in certain instances.

3. Carbohydrate.
   (*a*) This element furnishes heat and energy.
   (*b*) The excess is stored up as fat.
   (*c*) Carbohydrates lack vitamins and mineral salts.
   (*d*) Because they are preferred, they are often taken in place of food which would be of more value.
   (*e*) Mellanby states that cereals have been proved experimentally to have a deleterious effect on tooth calcification unless balanced by sufficient vitamin D.
   (*f*) The chief source of carbohydrate is sugar, cereals, fruits and grains.

4. Mineral salts.
   (*a*) These are of particular value in this discussion because the composition of bone is to a large extent calcium.
   (*b*) The relationship of phosphorus to calcium is also important to all bone formation.
   (*c*) In active rickets, the blood findings often show a high calcium and low phosphorus. The disproportion is of diagnostic value.
   (*d*) Milk contains all mineral salts in sufficient quantity if given in proper amount.
   (*e*) It is often a failure of absorption and not a lack of mineral salts in the diet which is the cause of trouble.

(B) Water.
   (*a*) One sixth of body weight is the minimum amount of water required daily.
   (*b*) Any condition which upsets the water balance may also upset the mineral balance to a marked degree.

(C) Sunlight.
   (*a*) This is of as much value to the growing child as it is to the growing plant.
   (*b*) Certain rays seem to exert a direct influence on body metabolism.
   (*c*) The sun's rays have a marked influence on the vitamin value of foods. Butter contains more vitamin A in the summer.

(D) Accessory foodstuffs (vitamins).

1. Vitamin A.
   (*a*) This was first spoken of as the growth vitamin.
   (*b*) It is now considered of more value as that vitamin which raises resistance to infection.
   (*c*) This vitamin probably plays as large a part, if not larger, than any other one vitamin.
   (*d*) Heat in the presence of oxygen destroys this vitamin.
   (*e*) It is found in cod-liver oil, butter, suet, egg yolk and, in a lesser degree, in other substances.

2. Vitamin B.
   (*a*) This is found in grains, particularly in husk and embryo.

(*b*) It is spoken of as the growth vitamin and will not be considered of much value in this discussion.

3. Vitamin C.
   (*a*) This is found in citrus fruits, tomato and in some degree in raw vegetables.
   (*b*) It is not found in cooked food, such as prune juice.
   (*c*) Lack of this vitamin produces soreness and hemorrhage of the gums, and the condition known as scorbutus, or scurvy.
   (*d*) Probably this vitamin does not affect the tooth directly but indirectly through the gum.
   (*e*) Percy R. Howe[4] made the statement that vitamin C plays a distinct and peculiar part in calcium fixation. He states that the antiscorbutic vitamin is one that profoundly affects bone and teeth and when a guinea-pig was given a diet deficient in vitamin C, odontoblasts ceased to form dentin within five to seven days. In ten days, the tooth softened. He also states that action on bone is the same.

4. Vitamin D (the dental vitamin, first isolated by Mellanby).
   (*a*) Its natural source is the same as that of vitamin A, one of the main sources being cod-liver oil.
   (*b*) It is also extracted in concentrated form by the use of violet rays on cereals and is known as irradiated ergosterol, or viosterol.
   (*c*) Two drops of this extract contains the same amount of vitamin D as one teaspoonful of cod-liver oil.
   (*d*) It is now generally accepted that exposure of the skin and foods to the sunlight or other sources of violet-ray radiation increases the calcifying properties by the synthesis of the antirachitic vitamin D from ergosterol. Olive oil, a substance deficient in vitamin D, when irradiated has, it is understood, some potent calcifying properties.
   (*e*) Cereals which actually interfere with calcification before irradiation may assist in calcification after such treatment.

There is no single naturally occurring food that satisfies all requirements for complete nutrition. Milk is Nature's most nearly successful effort to supply in one mixture a complete food, and yet milk alone is inadequate beyond the first few weeks of postfetal life. It is only by understanding and living up to all requirements of the diet that we may obtain complete nutrition.

Among the more common causes of improper balance in diet are the following:

1. Expense. Food materials which contain sufficient calcium and are adequate in certain vitamins, such as milk, eggs and butter, are relatively costly. Cereals, white flour breads, and other carbohydrate materials are cheaper sources of energy.

2. Ignorance. A great deal has been said about the poor teeth of the laboring classes. Since meat may comprise a disproportionately large part of the diet of these people, an inadequate calcium supply may thus be accounted for.

3. Taste. Many people prefer sweets. Appetite is satiated by large amounts of foods of this type.

4. Faulty criteria. Diets have been prescribed for children and their adequacy judged by the fact that the children grew and gained in weight.

It is a very peculiar and challenging circumstance that, with advancing civilization, the incidence of tooth decay has apparently shown a progressive increase. Early explorers of the North, we are told, found that the Eskimos, living largely on fat, were not only free from dental diseases[5] but were also without a word in their language to express pain

4. Howe, P. R.: Our Food and Our Teeth, Hygeia, 7:1212 (Dec.) 1929.

5. Hallilay, in: Toby, J. A., and Crumbine, S. F.: The Most Nearly Perfect Food, Baltimore: Williams and Wilkins, 1930.

of dental origin. Hallilay, of the British Service, has stated that it is by no means uncommon to find a perfect set of teeth in the jaws of octogenarian men and women of India, where, it is said, as much as a gallon of milk daily and little other food is taken. Eykman[6] states that, in the tropics, dental caries are very infrequent. McCollum[7] has reported that the skulls of several hundred Indians, from 200 to 300 years old, in the National Museum at Washington were examined and all teeth found perfect with the exception of a few which had been broken off. A recent examination of Italian children, average age, 12.5 years, who arrived in this country in 1922, disclosed that 88 per cent had good teeth, 1 per cent, poor teeth and the remainder, fair teeth. Of twenty-five Italian children, American born, average age 12.5 years, 95 per cent were found to have tooth defects. Of forty-eight American-born children, average age 6.5 years, 80 per cent showed defective teeth. In Italy, life is more primitive. The per capita consumption of sugar in the United States is far larger than in any other country, typifying the bad dietary habits which civilization has witlessly inculcated.

I am obliged to admit, after my review of the literature, that the dentist recognized, before the physician, the importance of diet in development and preservation of the teeth. Today, interest in this question is apparently becoming widespread. Mothers have begun to put some very pertinent queries to me. Only recently, I was called in to see a well-nourished infant of 10 days. The mother was middle-aged and had one other child, 15 years old. In her own words, her reason for calling me was as follows: "I was unable to nurse my first child at the breast. I find that I shall be unable to nurse this one. I gave my first child "Eagle Brand" condensed milk according to the directions on the can. He received no accessory foods until 1 year old. He was a fine, fat baby except that he had many colds. His teeth were late in coming and decayed very early. By the time he was 5 years old, he did not have a sound tooth among the deciduous teeth. He has had trouble also with the permanent teeth and at the age of 15 years has several decayed teeth. Is there not some diet that I could put my new baby on that would prevent this dental trouble?"

Surely, these various facts, typical of many in the experience and observation of dentist and physician, have clinical significance.

I think the time is appropriate for cooperation between the dentist and the pediatrician in eliminating fads and fallacies that are so common and without true scientific basis. I have in mind such prevalent fallacies and pet hobbies as are expressed in the slogans:

A clean tooth never decays.

Whole wheat breads are good sources of calcium and phosphorus for the teeth.

Rough foods are absolutely necessary to prevent decay.

Eat quantities of lettuce and green vegetables.

Sweets cause tooth decay.

Milk makes one fat.

Milk makes the child sick.

Milk should be taken slowly.

Pills of calcium and phosphorus salts are just as good as milk.

We should indict, also, such dangerous practices as the giving of parathyroid extract when the poor condition of the teeth is the only indication of a possible deficiency of this hormone. Such preachments and practices of the quack and ex-

6. Eykman in: Lyons, D. C.: Hygeia, 9:650 (July) 1931.

7. McCollum, E. V., in: Toby, J. A., and Crumbine, S. F.: Footnote 5.

ploiting manufacturer definitely impede a more general recognition of the value of proper nutrition and what constitutes proper nutrition.

To my mind the evidence is convincing that diet influences formation of the teeth in exactly the same degree that it influences formation of bone. Children receiving a diet adequate in all factors do not have rickets and do have good teeth. Conversely, dietary deficiencies indubitably are involved in the development of caries. Ample experimental work on both animals and human beings has demonstrated that caries may be arrested by feeding a good, well balanced diet. Let me cite, for example, the experiments of Nelson, Boyd and Drain.[8] These investigators fed to a group of diabetic children, 88 per cent of whom had shown definitely progressive caries prior to the beginning of the experiment, a diet of milk, cream, butter, eggs, meat, cod-liver oil, bulky vegetables and fruits. Dental caries was arrested in this group. The experiment was repeated with nondiabetic, normal children, and similar results were obtained. The oral hygiene of most of the subjects of these experiments was bad; toothbrushes were conspicuous by their absence. Hence, conclusions were drawn that dental caries of children under unfavorable hygienic conditions and environment was effectively arrested by means of the well-balanced diet with dairy products among its prominent features.

True, we do not know with certainty what individual components of foods are directly involved in the development of caries or its arrest and prevention. We do know that vitamin A raises resistance against infection of the system in general as well as of the teeth; that vitamin D not only promotes proper metabolism and calcification in the forming tooth, but is also largely responsible for development of the secondary dentition and in this way contributes to the arrest of caries already started; that vitamin C is essential to maintenance of the gums in sound condition and is generally accepted as the antiscorbutic vitamin; but until we know all the dietary factors in nutrition of the teeth, as well as the effective amount of each, it is assuredly the better part of wisdom not to overemphasize one factor at the expense of some other.

Sherman and Hawley[9] have shown that children retain more calcium and phosphorus when their intake of milk is at least 1½ pints. A dental survey of children receiving this amount of milk disclosed bad teeth. When the amount of milk was increased to 1 quart a day, caries did not occur. Of course, there is nothing sacred or magical about 1 quart of milk a day, but it would seem, in the light of the foregoing findings, that to include this amount of milk in the diet is playing more on the safe side of giving the tooth enough building material. Until we are absolutely sure, from repeated controlled study, that a pint of milk in the diet is just as adequate as a quart, I think we should give the larger amount.

I dwell on the subject of milk because there are many faddists today who are preaching a doctrine of less milk. They claim that milk takes the appetite for other foods; that the child gains more slowly on milk; that milk produces constipation and other ailments; that the dairy people should be stopped from advertising the food value of milk. I have always considered milk the rational food for the young infant. I believe that Na-

8. Boyd, J. D.; Drain, C. D., and Nelson, Martha V.: Dietary Control of Dental Caries, J. A. M. A. 91:1867 (June 9) 1928.

9. Sherman, H. C., and Hawley, E.: J. Biol. Chem., 53:375 (Aug.) 1922.

ture so ordained; and, except for the occasional child who is sensitized to milk, milk should continue to be a main factor in the diet. I have always taught that more than a quart of milk is unnecessary, and that accessory foods should be given from the very earliest period.

What of the breast-fed infant? I have shown in an earlier table that calcification of the tooth begins very early in embryonic life, and that the diet of the mother undoubtedly affects both the bones and the teeth of the fetus. It is also true that the diet of the nursing mother is just as important to the proper nutrition of her infant. Furthermore, the breast-fed baby, as well as the bottle-fed infant, should receive accessory food. It is only occasionally that we see a mother who produces sufficient good breast milk to nourish her offspring properly. Even though this breast milk may be sufficient at first, there is often a period of deficiency, when rickets and caries as well as other forms of malnutrition will appear.

Our breast-fed babies are fed on the same general plan as our bottle-fed babies. Vitamin in the form of cod-liver oil is begun with every infant at 1 month. Vitamin in the form of orange or tomato juice is begun at the same time. Some solid food, such as vegetable puree, occasionally a cereal and egg yolk, is begun by the sixth month. In virtually all breast-fed babies, an artificial feeding of modified cow's milk is added early, and more accessory foods are added gradually, until the infant weans himself, by the ninth month.

In all artificial feedings of infants, some form of milk forms the basis of the diet.

The feeding of the children is carefully supervised up until school age, and frequently longer. The amount of cod-liver oil is gradually increased, less being given in the summer than in the winter months.

In this connection, I wish to call particular attention to a prevalent fallacy that viosterol, or irradiated ergosterol, is a substitute for cod-liver oil. The results of experiments by Bliss, Prather, and Nelson[10] indicate that:

1. In animals fed on a purified diet adequate in protein, inorganic salts, calories and vitamin B, growth is maintained for a shorter period, then the weight becomes stationary or decreases, xerophthalmia develops and infection occurs, particularly in the upper respiratory tract. The amount of calcium deposited in the bone was small.
2. The addition of viosterol in the foregoing diet increased the calcification of the bone. It does not increase growth and does not prevent xerophthalmia, but rather aggravates it. Upper respiratory infection is not improved.
3. The addition of cod-liver oil to the aforementioned diet results in excellent growth, better calcification of bone and fewer respiratory infections.
4. Viosterol, therefore, does not demonstrate the power to stimulate growth and development of body and vital organs or prevent infections of upper respiratory tract, or to produce the same degree of calcification and growth of the bones as does cod-liver oil.
5. Since "colds," malnutrition and intestinal inadequacies are more frequent in children than rickets, this study emphatically suggests that the apparently widespread substitution of viosterol for cod-liver oil in the diet of the child is not logical and may result in an appreciable decrease of the child's strength and resistance to infections.

These, as well as my own clinical experience, indicate to me that, for development of teeth and formation of bone, vitamin A, the resistant or noninfectious vitamin, is still probably more important than vitamin D. I believe, further, that vitamin D, as separated in the form of viosterol, certainly is more effective when

10. Bliss, A. R.; Prather, E. O., and Nelson, Martha V.: Viosterol and Cod Liver Oil, Am. J. Dis. Chil. 42:52-56 (July) 1931.

given in conjunction with cod-liver oil. I do not mean to decry entirely the use of viosterol. I think it is a distinct addition to the treatment of rickets and caries when given in conjunction with cod-liver oil.

A correctly balanced diet is just as essential, with cod-liver oil and viosterol therapy, as is a correct diet for the diabetic under insulin therapy.

I have only to look back over my own experiences to appreciate the profound changes which have come about in our methods of treating the problem of the tooth. A number of years ago, when I was chief inspector of schools of the city of Memphis, we established dental clinics in most of our schools. Our whole effort at that time was to teach the child the use of the toothbrush. A toothbrush drill was instituted. Long talks were given to the children on the necessity of mouth hygiene. Dental surveys made from time to time showed little if any reduction in the incidence of caries. The only diet instruction given at this period was that rough food, requiring thorough mastification, was essential to proper tooth development.

What of those cases of badly misshapen dental arches, protruding teeth and other forms of tooth malformation, in which the orthodontist plays so important a rôle? Mothers have been told from time immemorial that thumb sucking, pacifiers and other mechanical devices are responsible. While we recognize that inherited characters determine to some extent the shape of the face, the dental arches and the sinuses, we know also that the adenoid, causing improper breathing, will undoubtedly have its effect. I cannot help believing that many of these deformities are related to improper feeding, and could be prevented, as rachitic deformities can be prevented, by diet.

CONCLUSION

1. A properly balanced diet promotes growth and development of teeth.

2. Diet control should be instituted by the obstetrician with the prospective mother.

3. If the child is breast-fed, the mother's diet should be supervised throughout the nursing period.

4. The breast-fed baby as well as the bottle-fed baby requires accessory food. Cod-liver oil, viosterol and orange juice do not take the place of a proper diet, but are very necessary adjuncts to the diet regimen.

5. Mouth hygiene is necessary but will not prevent caries. It has been shown that caries occurs in the mouth when the toothbrush has been used religiously.

6. Dental supervision should be begun at an early age.

7. During childhood, the bones, the framework of the body, are formed. If these are misshapen at the end of this period, they remain so. During the same period, beginning in the early embryo, the foundation of proper teeth is laid. It is too late to wait until the damage has been accomplished.

8. Preventive dentistry in children is all important and is closely associated with preventive pediatrics.

9. Such educational propaganda should be initiated by the dental and medical profession and not left to the faddist, the lay magazine and the quack, as these agencies will undoubtedly magnify the principles most valuable for their own particular use.

BEHAVIORISM AND ITS RELATION TO THE CHILD AND THE DENTIST*

By C. W. HAGAN, D.D.S., Pittsburgh, Pa.

I AM not a psychologist nor do I lay claim to any knowledge of psychology above that of the average person. I do believe that no person will be able to successfully cope with children unless he knows something about the underlying cause of their emotional responses. Any statements which I make with regard to the theory of behaviorism or the experiments performed to prove its fundamentals are obtained from the writings of John B. Watson of Johns Hopkins University and Phyllis Blanchard of the University of Pennsylvania.

There are two widely diversified opinions with regard to the number and nature of emotional responses. One group of psychologists believes that there are many original emotions in man, each aroused by certain definite stimuli and each producing certain specific reactions. The other group, the behaviorists, claim that there are but three primary emotions which can be definitely produced in the untrained infant and that to a large degree the attitudes which an adult displays are due to the way in which these emotions are conditioned during childhood.

According to John B. Watson, who is the chief exponent of the behaviorist group, the only emotions which can be absolutely demonstrated in the newly born are fear, love and rage. These three form a part of the original and fundamental nature of the infant and can be demonstrated by the proper stimuli. The sudden removal of support or a loud sound will produce the responses of fear. These responses consist of suddenly catching the breath, closing the eyes, puckering the lips and crying.

Restraining or hampering the movements of the infant's arms, legs or head will cause it to scream, stiffen the body and push with its arms and legs. When the rage is intense, the breath may be held for long intervals, and the older child will kick or slap at the object of its rage. The emotion of love apparently includes any form of attachment or satisfaction and is demonstrated by smiling, the characteristic sounds made by a contented infant and a little later extension of the arms. These responses are produced by manipulation, rocking, patting and caressing the child.

The specific stimuli indicated and the various responses outlined above for each emotion were the only emotional indications that could be demonstrated in the untrained infant. With age and training, the number of emotional reactions and responses, of course, increases.

For some time before the emotions were studied through laboratory experimentation, psychologists were familiar with a certain mechanism known as the conditioned reflex. This was first demonstrated through experiments on ani-

*Read before the Section on Mouth Hygiene and Preventive Dentistry at the Seventy-Third Annual Session of the American Dental Association, Memphis, Tenn., Oct. 21, 1931.

mals by a Russian scientist, Pawlow. We are all familiar with the way a dog's mouth will "water" when he is shown a piece of meat. The meat in this case would be considered the original stimulus and the salivation the original response or reflex. Pawlow showed that by repeatedly associating some other stimulus with the original one, the substitute would produce the same response as the original stimulus. For example, if a bell is struck every time the dog is shown the meat, in time the mere sound of the bell itself will produce the salivary response. When this is done, the substitute is known as the "conditioned stimulus" and the response produced as the "conditioned reflex."

The conditioning of reflexes has been studied in experiments with children, and it has been shown that without doubt certain habits connected with eating, sleeping and other activities have been modified by conditioning.

The knowledge of the conditioned reflex next led to similar experiments with the primary emotions, and it was found that the emotional responses of a child could be conditioned in a similar manner to the reflexes. Although all three of the primary emotions have been conditioned, the conditioning of the fear response is the most familiar and, from the standpoint of the dentist, probably the most important. Repeated presentations of animals to young children demonstrated the fact that there was no original fear response to them, either generally or individually. In every case, when the animal was shown to the child for the first time, interest was shown and frequently the child would reach out to touch the animal. If a loud noise was made simultaneously with the presentation of the animal, the child would show typical expressions of fear, and, after a few repetitions of this, the animal alone was sufficient to produce the fear response. Thereafter, instead of being interested in the animal and reaching for it, the child was afraid of it and would cry when he saw it.

In ways similar to this, the child's original emotions are conditioned and his outlook on life and his approach to the world determined. In connection with this thought, permit me to quote from Dr. Blanchard:

> In the uncontrolled environment of home and school and in the social environment away from supervision of parents and teachers, the conditioned emotional responses are constantly in the process of formation. The emotions originally aroused by a limited number of stimuli are attached to an unlimited number of situations which have become associated with those primarily effective. Thus fear, anger and love broaden their scope, sometimes to the child's advantage and at other times to his disadvantage.

When the emotional response is conditioned to a particular situation, it may be transferred to many similar situations. For example, the child who has been taught to fear a rabbit will frequently be afraid of other animals, or even other furry objects. There are cases on record in the experiments of Dr. Watson in which the fear has been transferred to a fur coat. It is a common occurrence for a child who has had a painful operation or who has gone through a series of painful treatments to include a fear of the dentist with his fear of the physician.

When the process of conditioning the emotional response was understood and the possibilities attached to it became known, the next important question was, can these responses be changed? Or must the child, whose emotions have been conditioned to its disadvantage, go through life with this handicap?

By virtue of experiments carried on with children, it was found that emotional responses could be unconditioned,

but only by setting up new responses in association with different situations. Reasoning with the child, explaining how the condition originated, saying that other children were not afraid, were found to be unavailing; but Watson found one method to be effective after all others had failed. A child was conditioned to fear in the manner described above, but, in this case, instead of an animal, a bowl of goldfish was used. The response was so great that he would not enter a room if he saw a bowl of goldfish in it.

The method of unconditioning was as follows: While the child was eating, a bowl of goldfish was quietly brought into the room. Thereafter, at each meal the fish were brought nearer and nearer. At first, he was undecided, but his desire for food was stronger than his fear. After this procedure was repeated a number of times, the child's fear seemed to have entirely disappeared and he reacted to the fish in the same manner as children who had never learned to fear them. In this case, a new response was set up toward the fish through the child's interest in a new situation (that of eating).

Another case, reported by M. C. Jones, seems to indicate that the attitude of other children may have an effect toward unconditioning an emotional response. This particular child was terrorized at the sight of a rabbit and also manifested fear toward white rats and other animals. It was arranged that the child play regularly with three other children who were not only not afraid of the rabbit, but also attempted to make a pet of it. It was observed that after witnessing the other children's actions toward the animal, the child's fear decreased daily. Unfortunately, further observations were interrupted at this point by illness of the child. While he was away, he was frightened by a dog, and, on his return, he was as much afraid of the rabbit as before.

At this point, the method used by Watson described in the previous case was adopted, with gradual improvement noted. Finally, the two methods were combined, and one of the other children was present at meal time. The rabbit this time was brought so close as to distress the child and he began to cry. The other child ran over to the cage of the rabbit, and finally the frightened one followed. The improvement from that time was marked and soon the fear had disappeared.

The theories of the development of the emotional attitudes of a child should be of particular interest to the dentist, for, aside from the parents and the school teacher, the dentist probably sees more of his emotional side than any other person. The child comes to the dental office after a night of suffering and in all probability is suffering at the time. Our actions then will have much to do with conditioning him favorably or unfavorably toward dentists. Perhaps he has already heard lurid tales of suffering occurring in the dental chair and is prepared for the worst. What will you do then to uncondition his emotional pattern already formed? Suppose he is a child who, through environment, has had some particular emotion overdeveloped, and that, by some study on your part and some knowledge of the underlying causes of his condition, you can remedy it. Would it not be worth the effort?

If the dentist is to treat the dental disorders of the child with a minimum of discomfort to himself and a maximum of cooperation from the patient, he must unquestionably understand something of the emotions in general and be able to apply

that knowledge to the individual before him.

As a working basis, suppose we accept the theory of the behaviorists and consider that there are but three primary emotions and that the actions of our patients are caused through modification and conditioning of these emotions. Our first consideration then would concern which of the three to stimulate and which to avoid. Undoubtedly, the answer is to avoid fear and rage and to encourage love. When we say love, we are not thinking of the spirit which makes spring poets, nor the thing written about in popular songs, but rather of the emotion which creates loyalty and respect. Our second consideration would be: how can we avoid that which we wish to avoid and stimulate that which we wish to encourage? After that comes the thought that, without doubt, there will be persons whose emotions have been conditioned to their disadvantage and ours. What can we do to overcome the old responses and substitute new ones?

Three weighty problems surely. And no one can lay down any hard and fast rule as to how to solve them in each individual patient. When we have a pathologic condition to treat, we get the history of the patient and study the origin of the disease, tracing it to its present status. Then, we plan the course of treatment to follow. Therefore, in our attempt to control the emotional actions of our patients, let us go back to the genesis of the development of the emotions. There we find three primary emotions, each of which responds to certain specific stimuli. We find further that, as the child develops with age and training, the number of reactions and responses increases; also, that these emotions may be conditioned to respond to new stimuli. With these points in mind, the patient must be studied and a diagnosis made as to his emotional character and the course to be pursued in relation to it.

If the child is normal and free from improper or unsatisfactory reactions, we can stimulate his loyalty and respect for us by similar conduct on our part toward him and at the same time prevent any reactions of fear or rage toward us. The methods used to accomplish this are familiar to us all.

The child who has learned to fear many things is liable to develop a feeling of inferiority. This feeling is unpleasant and he usually tries to escape from it in some way or other. Sometimes, he may give way to this weakness, and then we find the whining, crying child. Again, he may try to conquer his fear and, in order to convince himself and those around him of his courageousness, he assumes an overaggressive and bullying attitude.

The child in whom the emotion of rage has been overconditioned becomes sullen and defiant. He will resent restraint, is ever ready to rebel against authority and becomes suspicious of intention toward him.

When the child has been protected against the emotions of fear and rage, we find him cooperative, trusting, friendly and loyal. On the other hand, when he has had too much love and petting, we find the type known as the "spoiled child."

The types of children just described, with one exception, are the ones who give the dentist gray hairs and cause him to "lose his disposition"; yet these characteristics all arise from improper conditioning of some emotion, and psychologists assure us that, to a large degree, these reactions can be overcome. Obviously, it is impossible to overcome a fear of the dentist by operating while the child

is eating; but the dentist can make an effort to understand his patient and find out if possible what underlies his actions and then, to overcome them, follow whatever course his better judgment suggests.

Before we construct a bridge or make some other similar restoration, we make casts of the case, study them and then make our diagnosis. Therefore, is it not logical to believe that we would accomplish far more in the intricate task of dealing with the emotional nature of a child if we would only study our problem before we act?

CURRENT LITERATURE

EXTRACTS AND ABSTRACTS

Cooperation of Dentist and Otolaryngologist: According to Spilman (*J. Indiana M. A.*, Oct. 15, 1931), the intimate relationship between the maxillary sinus and the teeth is one evidence of the overlapping of the work of dentist and otolaryngologist. He believes that, in the treatment of maxillary sinus disease, the medical specialist often fails to consider the possibility of dental disease as a factor in the condition. In some cases of disease of the antrim, the services of a well-trained dentist are required for detection of the pathologic dental condition. The examination of the oral cavity by the dentist should include the employment of roentgenograms, transillumination and vitality tests, both thermal and electrical. In every case of antrim disease, a thorough mouth examination should be made by a competent dentist. Closer cooperation between otolaryngologist and dentist will result in benefit to all concerned, alleviating the suffering and disability of the patient.

Acute Osteomyelitis of the Superior Maxilla in an Infant: Roehm (*Am. J. Dis. Child.*, November, 1931) reports a case of acute osteomyelitis in a boy of 5 months, the first symptoms being acute adbominal distress, with rise of temperature. After negative findings from urinalysis and roentgen-ray examination of the chest, and when the temperature continued to rise, with a white cell count of 17,500, an exploratory laparotomy was made and the appendix removed because of a few enlarged glands at its base. Two hours after operation, the nurse noted marked swelling of the eyelids, which spread rapidly. The next day the right cheek was swollen and hard, and examination revealed a sinus, the size of a pinpoint and draining pus, over the right lateral incisor of the right maxilla. Both sides of the nose were closed by the swelling. On the second day after the operation, the posterior portion of the alveolar process appeared gray and tense and was therefore incised, drainage starting in a few hours. On the seventh day, a second sinus appeared, which drained freely. *Staphylococcus aureus* was obtained. Two other sinuses developed in the affected region, and incision was followed by drainage of pus. The fifteenth day, acute bilateral parotitis developed, and the next day, edema of the scalp over the right parietal region and of the tissues under and around the right ear. The swollen area became fluctuant, was incised and began to drain freely. Improvement ensued from this time on, although the temperature, which had been 103-104, did not go below 100-101 F. Roentgen-ray examination revealed complete disappearance of the right nasal bone and the whole lower half of the orbit. The patient was sent home for convalescence, but the temperature range remained the same. Sequestrums were extruded from both the anterior and the posterior portions of the alveolar process of the right maxilla, and the first upper incisor was removed with a hemostat without bleeding. One and a half months after the onset of the illness, the infant was again hospitalized because of a persistent cough with production of much pus. A roentgenogram revealed multiple areas of emphysema, apparently caused by mucopurulent plugs, combined with small pneumonic areas. As the lungs cleared, the temperature subsided. Convalescence was long and slow, but the end-results were good.

MISCELLANY

BOOK REVIEWS

Sun Yat-Sen Versus Communism — New Evidence Establishing China's Right to the Support of Democratic Nations. By Maurice William, Author of the Social Interpretation of History; A Refutation of the Marxian Economic Interpretation of History; 232 pages; price, $5; published by the Williams & Wilkins Company, Baltimore.

In the June, 1931, issue of THE JOURNAL, there was an article by William J. Gies on "A living American Dentist's Epochal Intellectual Contribution to World History," calling attention to the remarkable change that had been made in Chinese philosophy through the teachings of Dr. Sun Yat-Sen and particularly the change that came over the ideas of this eminent writer shortly before his death. This change constituted an almost abrupt reversal of opinion on some of the leading questions of the day as they affect the welfare of China, and the significant fact was that Dr. Sun's change of opinion was the result of reading a book by an American dentist, Maurice William, entitled "The Social Interpretation of History."

The publication of these facts created a great deal of interest, not only in the dental profession but among social philosophers and thinkers as well. Thus, when it became known that Dr. William contemplated writing another book in further elucidation of his ideas, and giving conclusive evidence of the close connection between "The Social Interpretation of History," and the latter-day opinions of Sun Yat-Sen, there was naturally much interest on the part of the leading sociologists of the day. The present volume is the outcome.

To indicate the hold that this volume has taken on advanced thinkers, it is necessary only to state that commendatory comments have come from such men as James T. Shotwell, professor of history, Columbia University; Jeremiah Whipple Jenks, research professor of government, New York University, and Harley Farnsworth MacNair, professor of far eastern history and institutions, University of Chicago, and author of "China in Revolution." The foreword to the volume was written by Ray Lyman Wilbur, Secretary of the Interior in the cabinet of President Hoover. All of this is significant of the importance attached to this volume. As Dr. Wilbur says: "The interaction of mind upon mind shown by the effect of Mr. William's 'Social Interpretation of History' upon Sun Yat-Sen is dramatic, if not epochal."

To students of current history, this book will prove a mine of information. In the midst of all the economic and social unrest throughout the world today, any influence that tends to stabilize opinion and clarify thought must be welcomed in no uncertain manner. The teeming masses of China have a potentiality for good or ill that is hardly conceivable today, and their relationship to the rest of the world, and particularly to America, is of major concern. False doctrines promulgated throughout the Chinese people constitutes a serious menace to the well-being of humanity, and it is therefore important that every avenue of enlightenment shall be opened to these people. It would sometimes seem as if sanity and stable doctrine were in the balance at this time the world over, and it is very vital that the scales shall be tipped in the right direction. Considering the immense influence wielded by the late Dr. Sun, it is more than an incident that his views were so radically changed in the direction of constructive thinking, and it is to the credit and honor of the dental profession that one of its own members was so largely instrumental in bringing this change about.

Dr. William is to be congratulated on his signal achievement, and his book is heartily commended to the consideration of every individual who has the welfare of humanity at heart.

The Art of Porcelain in Dentistry. By Fred R. Felcher, D.D.S., Chicago; 277 illustrations; 360 pages; price, $9; published by the C. V. Mosby Company, St. Louis.

The need is progressively more apparent for the development of porcelain art in the practice of dentistry. The "art that conceals art" is the highest expression of esthetic achievement in the restoration of lost teeth or portions of teeth, and everything that contributes to the successful consummation of this art must receive the most whole-souled encouragement and commendation of every progressive member of the profession.

The present volume constitutes a very notable attempt to add to the sum total of authentic information on the subject, and it is therefore a distinct addition to the literature of porcelain. The author has worked extensively in porcelain for years and is thoroughly conversant with all phases of the subject. He has brought to his aid a very abundant illustrative program of every conceivable procedure outlined in the text, thus rendering it easy for anyone at all familiar with the subject to follow the various processes. When it is stated that 277 illustrations are used in a book of 360 pages, it will be apparent that the textual descriptive matter is well supported by cuts. With a subject in which technic is vital, this is very important. Another commendable feature is the excellence of the paper, which lends itself to the best possible reproduction of the drawings and halftones. The book is one that will appeal to everyone interested in porcelain, and in view of the fact that this work is being more and more demanded in dentistry, the present volume should enjoy a wide distribution.

A Manual for Dental Assistants. Edited by Albert Edward Webster, D.D.S., M.D.S., M.D., F.A.C.D., Honorary Dean and Professor of Operative Dentistry, Faculty of Dentistry, University of Toronto; Honorary Member of the British Dental Association; Past-President of the Canadian Dental Association, American Institute of Dental Teachers, and President of the International Association for Dental Research; Editor of the Dominion Dental Journal; illustrated with 215 engravings; price, $3; 356 pages; published by Lea & Febiger, Philadelphia.

This is a more pretentious volume than any that have preceded it on this subject. The editor has brought to his aid the cooperation of several writers, who have contributed to the different subjects. These writers are experts in their respective fields, and the result is a well-rounded consideration of the various topics brought into a comprehensive whole.

To give an idea of the scope of the volume, the following statement is made: "The authors in presenting this manual have no thought of teaching dentistry; their purpose is to train dental assistants in the shortest possible time. They hope so to stimulate young women in dental offices that they themselves will devise methods of assisting."

The book begins with the study of a dental office, its arrangement, etc., and then very appropriately goes on to a consideration of ethics, a topic which should be of especial concern to a dental assistant.

Two of the functions outlined in the volume as being of great importance to the assistant are housekeeping and bookkeeping. In each of these, the assistant should be thoroughly grounded. Manifestly, the responsibility for keeping the office in order should lie almost solely in the hands of the assistant, as also should the keeping of accounts and records and the collection of bills. A tactful and discriminating assistant can manage such matters much better than can the dental practitioner, as is amply illustrated in the present volume.

One chapter is devoted to a list of instruments, appliances and therapeutic agents with which the assistant should be made familiar. This list is very comprehensive, and if the assistant thoroughly masters it, she will be well on the way to a knowledge of the technical procedures necessary for her every-day duties.

We cannot imagine a single function of legitimate dental assisting that is not outlined in this book, and we commend it to the careful study of every young lady who aspires to engage in this very interesting field. A general knowledge of this volume will add greatly to the efficiency of this type of service, and the authors are accordingly to be commended for a very worthy contribution to the literature of dentistry.

A Doctor of the 1870's and 80's. By William Allen Pusey, Sometime President of the American Medical Association and of the American Dermatological Association; 153 pages; price, $3; published by Charles C. Thomas, Springfield, Ill., and Baltimore, Md.

In these days of specialization, we frequently hear the lament that the old family doctor is rapidly becoming a thing of the past, and even the general practitioner of dentistry is threatened by the inroads of specialists. But with dentistry more than with medicine, the large majority of practitioners fortunately will remain in general practice. Something very vital in the practice of medicine went out of the profession when the old-time country physician disappeared, and it is refreshing to catch a glimpse now and then of what this particular type represented.

Dr. Pusey has given us in this volume a very intimate portrayal of country medical practice through the career of his father who

practiced in the seventies and eighties, and who represented the best traditions of what such service might mean. It is refreshing to get this close at hand day by day contact that Dr. Pusey had with his father in those early years when, as a student, he accompanied him on his professional visits to all parts of the country embraced by the region in which he practiced.

The early Pusey represented a sturdy type of professional manhood, and an example set by so worthy a father was a great asset in later life to the son when he went into practice himself. Manifestly, the lessons taught in this book have to do not only with the problems met in country practice and the methods to be used in their solution, but also with the best traditions of medicine generally as represented during the period. There is a close human touch to it that adds to the volume and makes more than an ordinary appeal to the professional man.

Altogether, Dr. Pusey has written a book that is well worth reading and that will be found interesting by the dentist as well as by the medical man.

Dilemmas of Dentistry. By Oscar Farkasch, Vol. I; 233 pages; published by Dodd Brothers, New York City.

This book is a running comment on the experiences of various members of the profession in conducting a dental practice. It recites several types of failure in building a practice, with an intimate comment on the causes, and, finally, it outlines the career of a very successful practitioner with the chief agencies that brought about the success. As the author intimates, the suggested policy will not fit into the requirements of every practitioner, but there are many intimations in the book that have a constructive bearing on dental practice, and so are well worthy of consideration.

SOCIAL INSURANCE: GOVERNMENTS, INEFFICIENT OR CORRUPT, OR BOTH (Cont.)

By Edward H. Ochsner, M. D., Chicago, Ill.

We come now to what is probably the weakest spot in the government, the judicial interpretation of the laws and their legal administration. Some of the worst features in the administration of criminal justice in particular, in most of the states and sometimes even in the federal courts, are the result of countless postponements, hair-splitting technicalities, innumerable appeals and numerous reversals, with the resultant delays and miscarriage of justice. Volumes could be written on this subject alone, but one illustration of each method of delaying justice will have to suffice.

A known gunman has been indicted six times in the last eighteen months. Every time he has been released on bonds, he has been involved in new crimes. In spite of all this, he was given thirty continuances on the first indictment. Commenting on this and many similar cases, Henry Barrett Chamberlin operating director of the Chicago Crime Commission, recently made this statement: "Repeated postponements in the trial of a criminal case is the most serious obstacle in obtaining a just verdict."

The following is an illustration of how intense legalism and the glorification of technicalities only too often defeats justice. The case is taken from the decision of the Illinois Supreme Court, volume 258. This decision was handed down many years ago, but it still stands. An 11-year-old girl was dragged into a basement apartment and mistreated by a 50-year-old man. He was found guilty and sentenced to the penitentiary for five years. The Supreme Court reversed the sentence, not because of any doubt concerning the defendant's guilt, but because the child's first name had been set forth as Rosetta instead of Rosalia in the indictment.

In most major criminal cases in nearly all of the states of the Union, the convicted person has three and sometimes even more chances of appeal and one or two chances of executive clemency. Each time, he has a chance to find a loophole and to make his escape; while society is denied an equal chance to protect itself.

Our laws have been so emasculated by mollycoddle reformers that it is almost impossible to convict a criminal and keep him convicted or to convict one or a group of men who maladminister government departments. A case in point: Between the years 1915 and 1919, four real estate experts were paid $2,736,868 out of the city treasury. It was common knowledge that the payments were grossly excessive and that a good deal of this money ultimately found its way into the political fund of the administration, and yet the Supreme Court reversed the verdict of the Circuit Court which had found the defendants guilty, claiming that the prosecution had not

proved that any member of the administrative body had personally received any of the money. To the layman, the language of the Supreme Court seems to say that if the administrative officer chooses to look in the other direction when the money is being stolen, he cannot be held responsible. I do not presume to criticize the courts in these decisions: the fault may be in the laws; but no one will claim that all this spells governmental efficiency, and that is the point under discussion here. In this connection, I wish to quote a jurist who was known for his outstanding fearlessness and integrity and his profound knowledge of the law. He characterized the municipal and circuit courts as the Courts of Original Error, the appellate courts as the Courts of Intermediate Speculation and the Supreme Court as the Court of Ultimate Conjecture.

While most of these illustrations have naturally been taken from Chicago and Illinois, similar instances in many other places prove that conditions are just as bad. We need but refer to the recent dismissal of five judges for gross inefficiency and corruption in New York City, and to an address of Samuel Seabury to the justices of the appellate division of the Supreme Court of New York in which he said, "It is for you to say whether the magistrates' courts shall be turned into bargain-counters where justice is bought and sold, when political leaders are brokers dealing in influence." In smaller governmental units, the corruption and inefficiency is, of course, on a smaller scale, but, in many instances, it is there just the same. One writer in a popular magazine sizes up the whole situation in the following words: "From Teapot Dome to our latest municipal court scandals, we have seen enough of political and public malfeasance to believe almost anything of our law-makers, courts and public guardians."

I have devoted this much space to the discussion of governmental inefficiency because it is fundamental. If I have demonstrated that most governments are inefficient or corrupt and that some are both and that there is no likelihood of marked improvement in the immediate future, I have proved that it would be unwise and unsafe to entrust so vital a function as the almost universal control of medical practice to governmental supervision and control. If one were to record all the evidence of inefficiency and corruption which occur in all the governmental units of this country in one year alone, it would require volumes instead of a few short articles. The purpose of these articles is not so much to give detailed information as to arouse the allied professions of medicine and dentistry and, through them, the general public to the impending danger.

(The next two articles will show how the quality of medical services deteriorates under compulsory health insurance.)

A NATIONAL DENTAL MUSEUM

At the meeting of the American Dental Association in 1930, at Denver, a committee was appointed to study the feasibility of arranging a museum to house exhibits of interest to dentistry. When the committee entered upon its duties, it was discovered that many years ago, in 1885 to be exact, the then National Dental Association had by resolution designated the Army Medical Museum at Washington, D. C., as the official depository for the dental profession of the United States.

A meeting of the committee with the Surgeon General of the United States Army was arranged, and the latter heartily approved of a plan to reawaken interest in the dental division of the museum. Plans were shown at this meeting detailing the project of the government to build a new museum and library at the Army Medical Center in Washington. The space assigned to the Dental Museum was designed to occupy about five times as much floor area as in the present building.

The Committee on Museum then made a report to the American Dental Association, in 1931, at Memphis, and its recommendations were that the American Dental Association revive interest in this museum and make it the center of activities for this work in the United States.

This suggestion met with the approval of the Board of Trustees and the House of Delegates, and the committee was directed to continue its activities and arouse the interest of the dental profession in this museum, to the end that they would send specimens for classification, study or exhibit.

The profession is urged to send any such material, either anatomical, casts anomalies or historical specimens to the Curator, Army Medical Museum, Dental Division, Washington, D. C. As rapidly as specimens are received they will be classified and indexed.

The museum has facilities for accommodat-

ing properly accredited students, who may have access to the specimens arranged for study and also to thousands of slides of pathologic specimens.

It is hoped that the profession throughout the country will renew their interest in the museum and give it their support.

CORRESPONDENCE

To the Editor: Some time ago, there was a so-called detail man in the office representing himself as being employed by the Spearmint Products Co. of Memphis, Tenn. He had no literature nor samples. The product that he was supposed to be detailing was a milk of magnesia with a spearmint flavor. However this was only a ruse to get at his real game, namely, the peddling of a powder which, when dissolved in water, would give a solution that would remove rust and tarnish from instruments—a tablespoonful being added to the sterilizer water. I believe that this is nothing more than our old friend sal soda plus a little whiting. I am enclosing a small sample, also the cover of his package. I also wrote to the firm that he was supposed to represent, but the letter came back unclaimed. I am enclosing it for your examination. It also goes into detail relative to this man's method of operation. I might add that he collected quite a few dollars in this community, as he has done no doubt in many others. I am passing this information on with the thought that it may be valuable to other members of the profession.

This man weighs approximately 135 pounds, has a very sallow complexion, almost yellow, is about 5 feet 5 inches in height, very nervous and an inveterate cigaret smoker. He says that he is troubled with pleurisy. He claims Minneapolis as his home.

We have given this product a fair and thorough trial and find that it will not do what is claimed for it.

F. O. Raasch
2703½ Central Ave.
Kearney, Nebr.

To the Editor: In the review of "Fifty Years of the A. D. T. A.," published in your February issue, the last paragraph states: "The reviewer does not know the price of the book."

We have made these books available to our members at a price of $1, and will be pleased to make them available to others interested at the same price, plus postage.

For the archives of state dental societies, officers, etc., we shall be pleased to compliment these books.

I know it is needless to say to you that the cost of publishing the book was in excess, considerably, of the price we are charging.

Cordially yours,
George A. Lilly, *Managing Director*
A. D. T. A.

NEWS

Death of Mr. Eastman: In the recent death of Mr. George Eastman, of Rochester, N. Y., dentistry saw the passing of its most generous patron. Beginning with the founding and endowment of a dental clinic for indigent children in his own city, the philanthropies of Mr. Eastman have spread to the leading countries of Europe, where clinics have been established or are nearing completeion in London, Paris, Rome, Brussels and Stockholm. It is believed that these concrete expressions of Mr. Eastman's belief in the great value of dental care as a general health measure have been responsible for other large contributions to the dental welfare of the public, such as those of the late Mr. Julius Rosenwald, of Mr. and Mrs. Guggenheim and of Joseph E. Samuels.

Dr. Wright Appointed to Health Board: The appointment of W. H. Wright, of Jackson, Miss., to the Mississippi State Board of Health for the period of Jan. 1, 1932-Dec. 31, 1938, has been made by the governor of the state.

Dr. McKevitt Appointed to Health Board: Frank H. McKevitt, San Francisco, Calif., has been appointed to the Board of Health of the City and County of San Francisco, under the provisions of a new charter providing for the appointment of a dentist to the board.

Death from Radium Poison in Tonic: Recently, a case of radium poisoning resulting from use of a supposedly harmless tonic consisting of water charged with radium gas, with death ensuing after two years, has been reported. The victim was said to be in good health at the time he began to take the "radium water," simply using the "tonic" because he believed that it would keep him in good physical condition. The dose taken was from 4 to 6 ounces a day. Physicians generally had regarded the water as harmless, but careful test revealed that it actually contained microscopic amounts of radium salt. This was

deposited in the bone and eventually caused great suffering. Physicians who were first consulted were at a loss to account for their patient's condition, which was manifest chiefly in the gums and teeth and in the facial bones. The condition was finally recognized by a physician who had had experience in the famous dial painting cases reported several years ago. It was determined that the recent victim had 36 micrograms of radium deposited in his body, and his death was ascribed to formation of brain abscess, which was said to have been predicted by his physicians as the probable result of the presence of the radium in his system.

A New Periodical: Fortschritte der Orthodontik: This is an international journal of orthodontia, edited by various contributors and published in Berlin, Germany. There has long been a need for such a periodical, and the editors have endeavored to meet the demand by publishing the titles of all articles and the description of the illustrations with a synopsis in the three languages—German, French and English. Eventually, it is hoped that the entire articles may be printed in the three languages.

Dedication of New Dental Building in Seoul, Korea: The dedication of the new dental building at the Severance Union Medical College and Hospital was held Oct. 28, 1931. This building was made possible largely through the efforts of J. L. Boots, D.D.S., who visited America a few years ago and raised funds from the members of the American Dental Association to help erect the building. The dedication exercises were very impressive, and a new impetus was given to the advancement of dental service in that part of the world. The dedication tablet bears the following inscription:

"This Dental Building has been made possible by the Generosity of Members of the American Dental Association in the interest of Science, International Good Will and the Development of the Health Program of Christian Missions in Korea."

Navy Surgeon General Honored: In recognition of the importance with which Admiral Riggs regards a complete medical service, which embraces also adequate and competent dental treatment, delegates of the American Association of Dental Schools in annual meeting at Columbus, Ohio, from March 21 to 25, 1932, unanimously passed the following resolution:

In view of the wise and far-sighted policies of Rear Admiral Charles E. Riggs, surgeon general, United States Navy, in creating a postgraduate board to recommend an ever-increasing number of dental officers for postgraduate instruction in civilian institutions, be it

Resolved, that the American Association of Dental Schools assembled in Columbus, Ohio, extend to Rear Admiral Charles E. Riggs, surgeon general, United States Navy, sincere felicitations and hereby expresses its earnest desire to cooperate fully with him in the furtherance of mutual interests, and be it

Resolved, that a copy of this resolution be forwarded to Rear Admiral Riggs and to the Hon. Charles Francis Adams, Secretary of the Navy.

The American Association of Dental Schools is formed by the amalgamation of the American Institute of Dental Teachers, the National Association of Dental Faculties, the Faculties' Association of American Universities and the Canadian Faculties' Association.—*Army & Navy Register,* April 9, 1932.

Death of Dr. Wolff:—Andrew Stratton Wolff died January 28, 1932, at his home in St. Louis, Mo., in his fifty-second year. Dr. Wolff received the degree of doctor of dental surgery from the Drake University Dental Department, Des Moines, in 1902. Immediately after his graduation, he located in St. Louis where he continued to practice his profession until the time of his death. He is survived by his widow, Mrs. Gertrude Allen Stratton, two sons, two brothers, Drs. S. C. Wolff, St. Louis, and J. Scott Wolff, Kansas City, and one sister.

Death of Dr. Roy: Joseph D. Roy of St. Louis, Mo., died February 21. He was born in 1871 in Montreal, Canada, and came to the United States in his early youth. He graduated from the Kansas City Western Dental College in 1892, and was actively engaged in the practice of his profession in the city of St. Louis for more than thirty-nine years. He had been seriously ill for more than four months previous to his death. His widow and one daughter survive.

Death of Dr. Wilson: Wilber C. Wilson, a practicing dentist in Chicago for forty-three years, died April 4, from a heart ailment. Dr. Wilson, who was 65 years of age, graduated from the Denver College of Dentistry in 1889. The widow, a daughter and two sons survive.

ANNOUNCEMENTS*

CALENDAR OF MEETINGS

American Dental Association, Buffalo, N. Y., September 12-16.

American Board of Orthodontia, Toronto, Canada, May 16-17.

American Dental Society of Europe, Baden-Baden, Germany, August 9-11.

American Society of Oral Surgeons and Exodontists, Buffalo, N. Y., September 9-10.

American Society of Orthodontists, Toronto, Canada, May 18-20.

Association of American Women Dentists, Buffalo, N. Y., September 12.

Fédération Dentaire Internationale, Zurich, Switzerland, August 2-9.

Interstate Dental Association, Bordentown, N. J., July 11-13.

Italian Stomatologic Congress, Rome, September.

National Association of Dental Examiners, Buffalo, N. Y., September 10.

Northern Ohio Dental Association, Cleveland, June 6-9.

Society for Advancement of General Anesthesia in Dentistry, New York City, third Monday in February, April, October and December.

Southern Society of Orthodontists, Knoxville, Tenn., October 31-November 2.

American Dental Hygienists' Association, Buffalo, N. Y., September 12-16.

STATE SOCIETIES

District of Columbia, at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June, inclusive.

May

Illinois, at Springfield (10-12).
Indiana, at Indianapolis (16-18).
Iowa, at Des Moines (3-5).
Maryland, at Baltimore (2-3).
Massachusetts, at Boston (2-5).
Missouri, at Joplin (16-18).
Nebraska, at Lincoln (16-19).
New York, at Albany (11-13).
North Carolina, at Elizabeth City (2-4).
North Dakota, at Minot (3-5).
South Carolina, at Greenville (23-24).
South Dakota, at Sioux Falls (16-18).
Texas, at Dallas (17-20).
Tennessee, at Memphis (9-11).
Vermont, at Burlington (18-20).
Virginia and West Virginia, at Winchester, Va. (16-18).

June

Arkansas, at Little Rock (6-8).
California (Southern), at Los Angeles (13-15).
Colorado, at Estes Park (20-22).
Georgia, at Atlanta (8-10).
Maine, at South Poland (16-18).
Mississippi, at Meridian (9-11).
Montana, at Bozeman (June 30-July 2).
Nevada, at Reno (4).
New Hampshire, at North Conway (1-3).
Wisconsin, at Milwaukee (7-9).
Wyoming, at Thermopolis (27-28).

July

New Jersey, at Bordentown (11-13).
Washington, at Seattle (5-9).

STATE BOARD OF DENTAL EXAMINERS

Alabama, at Birmingham, June 20. E. W. Patten, Secretary, Comer Bldg., Birmingham.

Arkansas, at Little Rock, June 20-23. Clarence W. Koch, Secretary, Donaghey Bldg.

Connecticut, at Hartford, June 22-25. Almond J. Cutting, Recorder, Southington.

Colorado, at Denver, June 7-11. Zenas T. Roberts, Secretary, Metropolitan Bldg., Denver.

Delaware, at Wilmington, June 20-23. W. S. P. Combs, Secretary, Middletown.

Florida, at Jacksonville, June 22-25. R. P. Taylor, Secretary, St. James Bldg., Jacksonville.

Indiana, at Indianapolis, June 15. J. M. Hale, Secretary, Mt. Vernon.

*Announcements must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

Iowa, at Iowa City, May 30-June 2. Hardy F. Pool, Secretary, Mason City.

Kentucky, at Louisville, June 8-11. Robert L. Sprau, Secretary, 970 Baxter Ave., Louisville.

Louisiana, at New Orleans, June 15-18. Joseph L. Webre, Secretary, Audubon Bldg., New Orleans.

Maine, at Augusta, June 20-22. Alton H. Swett, Secretary, 192 State St., Poland.

Massachusetts, at Boston, June 14-17. W. Henry Grant, Secretary, State House, Boston.

Minnesota, at Minneapolis, June 10-16. W. H. Smith, Secretary, 2337 Central Park Ave., Minneapolis.

Missouri, at St. Louis, June 8-11. George E. Haigh, Secretary, Central Missouri Trust Bldg., Jefferson City.

Nebraska, at Omaha and Lincoln, June 13-18. Mrs. Clark Perkins, Director, Lincoln.

New Jersey, at Trenton, June 27-July 2. John C. Forsyth, Secretary, 148 W. State St., Trenton.

New Mexico, at Albuquerque, June 14-18. J. J. Clarke, Secretary, Artesia.

Ohio, at Columbus, June 27. M. H. Jones, Secretary, 1553½ N. 4th St., Columbus.

Pennsylvania, at Pittsburgh and Philadelphia, June 16-20. W. A. McCready, Secretary, 1115 Highland Bldg., Pittsburgh.

Rhode Island, at Providence, June 28-30. Albert L. Midgley, Secretary, Union Trust Bldg., Providence.

South Dakota, at Sioux Falls, June 27-29. John J. Berry, Secretary, Deadwood.

Tennessee, at Memphis, June 13. F. W. Meacham, Secretary, Hamilton Nat. Bank Bldg., Chattanooga.

Texas, at Houston, June 20-24. A. L. Nygard, Secretary, Medical Arts Bldg., Dallas.

Utah, at Salt Lake City, June 27-30. H. D. Brockbank, Secretary, Medical Arts Bldg., Salt Lake City.

Vermont, at Montpelier, June 27-29. H. B. Small, Secretary, Burlington.

Virginia, at Richmond, June 14. John H. Hughes, Secretary, Medical Arts Bldg., Richmond.

Wisconsin, at Milwaukee, June 13-18. S. F. Donovan, Secretary, Tomah.

ASSOCIATION OF AMERICAN WOMEN DENTISTS

The eleventh annual meeting of the Association of American Women Dentists will be held at the Statler Hotel, Buffalo, N. Y., September 12. All woman dentists are invited to attend this meeting.

GENEVA E. GROTH, *Chairman*
Publicity Committee,
1301 Medical Arts Building,
Philadelphia, Pa.

ARKANSAS STATE BOARD OF DENTAL EXAMINERS

The Arkansas State Board of Dental Examiners will hold its next examination at the Hotel Marion, Little Rock, June 20-23.

CLARENCE W. KOCH, *Secretary*
817 Donaghey Bldg., Little Rock.

DELAWARE STATE BOARD OF DENTAL EXAMINERS

The next meeting of the Delaware Board of Dental Examiners will be held in the municipal building, Tenth and King streets, Wilmington, June 22-23, from 9 a. m. to 5 p. m. For further information, address

W. S. P. COMBS, *Secretary*
Middletown.

COLORADO STATE BOARD OF DENTAL EXAMINERS

The Colorado State Board of Dental Examiners will meet at 1340 Arapahoe St., Denver, June 7-11, for the purpose of conducting its regular semiannual examination of all applicants for a license to practice dentistry in Colorado. All applications should be in the hands of the secretary not less than one week previous to this date. For further information, address

ZENAS T. ROBERTS, *Secretary*
810 Metropolitan Bldg.,
Denver.

MISSOURI DENTAL BOARD

The next examination of applicants to practice dentistry in Missouri will be held at Washington University Dental College, St. Louis, June 8-11. Applications must be filed with the secretary at least ten days prior to the examination. For further information, address

GEORGE E. HAIGH, *Secretary*
Central Missouri Trust Bldg.,
Jefferson City.

NEW MEXICO BOARD OF DENTAL EXAMINERS

The New Mexico Board of Dental Examiners will hold its next examination for applicants to practice in New Mexico in Albuquerque, June 14-16. Graduates of Class A and Class B schools are eligible for examination. Blanks and information will be furnished on application to

J. J. CLARKE, *Secretary*
Artesia.

NORTH DAKOTA STATE BOARD OF DENTAL EXAMINERS

The next meeting of the North Dakota State Board of Dental Examiners will be held June 12-15 at the Gardner Hotel, Fargo. Applications, with fee, must be in the hands of the secretary at least ten days prior to date of examination. Address all communications for further particulars to

LARRY B. MCLAIN, *Secretary*
White Bldg.,
Jamestown.

SOUTH DAKOTA STATE BOARD OF DENTAL EXAMINERS

The next meeting of the South Dakota State Board of Dental Examiners will be held at the Carpenter Hotel, Sioux Falls, June 27-29. Applications should be in the hands of the secretary ten days before date of board meeting. For further information, apply to

JOHN J. BERRY, *Secretary*
Deadwood.

VIRGINIA STATE BOARD OF DENTAL EXAMINERS

The next regular meeting of the Virginia State Board of Dental Examiners will be held at the Medical College of Virginia, Richmond, beginning promptly at 9 a. m., June 14. Applicants are required to present a certificate from the state board of education showing that they have had one year of academic education equal to one year of college work. Applications, with fee and photograph, must be filed complete ten days before the examination. For application blanks and further information, apply to

JOHN M. HUGHES, *Secretary*
715 Medical Arts Bldg.,
Richmond.

MISSISSIPPI DENTAL ASSOCIATION

The fifty-seventh annual meeting of the Mississippi Dental Association will be held at the Lamar Hotel, Meridian, June 9-11.

J. F. BRUNSON, *Chairman*
Executive Committee,
Meridian.

NORTH DAKOTA STATE DENTAL ASSOCIATION

The annual meeting of the North Dakota State Dental Association will be held in Minot, May 3-5, the convention opening with a golf tournament May 2.

W. S. SHAW, *Secretary*
Fargo.

AMERICAN DENTAL HYGIENISTS' ASSOCIATION

The next annual meeting of the American Dental Hygienists' Association will be held September 12-16, at the Hotel Lenox, Buffalo, N. Y.

CAMILLE S. TOOLAN, *Chairman*
Publicity Committee,
30 Main St.,
Geneseo, N. Y.

TENNESSEE DENTAL HYGIENISTS' ASSOCIATION

The third annual convention of the Tennessee Dental Hygienists' Association will be held at the Peabody Hotel, Memphis, May 9-10.

RUTH HAZEL NOETZEL, *President*
1207 Medical Arts Bldg.,
Nashville.

EASTERN SOCIETY OF DENTAL ANAESTHETISTS

The fourth meeting of the season of the Eastern Society of Dental Anaesthetists will be held at the Hotel Westover, 253 West 72nd Street, New York City, May 20th. A dinner at 7:30 will precede the lecture which will follow at 8:30 p. m. Meetings are held on the third Friday of January, March, May and November and membership is open to all members of the American Dental Association.

JOHN B. WOODMAN, *Secretary*
57 West 57th Street,
New York City.

AMERICAN DENTAL ASSOCIATION

Buffalo, N. Y. Sept. 12-16, 1932.

HOTEL RESERVATION

In securing hotel reservations for the 1932 Session, consult the hotel rate-sheet and fill out the blank application below. Mail immediately to the hotel you wish to patronize. The hotel will then advise you of the reservation which has been made for you.

As your first choice may not be available, kindly indicate a second and a third choice. If none of these are available, the hotel manager will mail your application to the Chairman of Halls and Hotels Committee, who will make a reservation for you again in as favorable a hotel as possible.

Please remember that a reservation constitutes a contract with the hotel to provide you with the accommodations you desire. If you find it impossible to carry out your part of the contract, namely, to occupy the room at the time agreed on, please write or wire the hotel, releasing it, in order that your room may be available for other members.

MAIL THIS APPLICATION DIRECT TO THE HOTEL

HOTEL RESERVATION

AMERICAN DENTAL ASSOCIATION, BUFFALO, N. Y., SEPT. 12-16, 1932.

.....Hotel. .....1932.

Buffalo, N. Y.

Please reserve sleeping room accommodations as noted below:

.....Room (s) with bath for.....people. Rate desired $.....
(per day)

.....Room (s) without bath for.....people. Rate desired $.....
(per day)

Second choice hotel.....

Third choice hotel.....

ROOMS TO BE OCCUPIED BY: ADDRESS IN FULL

Applicant..... .....

....

....

Please confirm this reservation to applicant. I further agree to notify the hotel at once in the event I am unable to use this reservation.

IMPORTANT TO HOTEL MANAGER: In the event you cannot accept this reservation, please forward this application at once to Dr. J. G. Roberts, Chairman Halls and Hotels Committee, 1839 Hotel Statler, Buffalo, N. Y., who will attend to the assignment of this reservation.

HOTEL	With Bath One Person	With Bath Two Persons	Without Bath One Person	Without Bath Two Persons
ARLINGTON				
136 Exchange		$5.00		$3.00
BUFFALO				
Washington and Swan	$3.00 S	4.50 S*		
	3.50 T&S	5.00 T&S		
	4.00 T&S	6.00 T&S		
	4.50 T&S	6.50 T&S		
		6.50 TB		
CHELTENHAM				
234 Franklin		3.00-5.00 TB	$1.50	
FAIRFAX				
Delaware near North		5.00-8.00		
		Suites 10.00-12.00		
FORD				
Delaware near Chippewa	2.00 S	3.50 S-4.00 TB		
		4.50 S, 3 persons		
		6.00 S, 4 persons		
		7.50 S, 5 persons		
GRAYSTONE				
24 Johnson Park		3.00-5.00		
		6.00 TB		
LAFAYETTE				
Washington and Clinton	3.50	5.00-6.00		
	4.00	7.00 TB		
LENNOX				
140 North	3.50	5.00-6.00 TB	2.00	3.50-4.00
MARKEEN				
Main and Utica	3.00	5.00		3.00
	5.00	6.00 TB		4.00 TB
STATLER				
Niagara Square	3.50	5.50		
	4.00	6.00		
	4.50	6.50		
	5.00	7.00 TB		
	6.00	8.00 TB		
	7.00	9.00 TB-10.00 TB		
STUYVESANT				
245 Elmwood	3.00	4.00		
		Suites 5.00		
		Suites 6.50		
TOURAINE				
Delaware and Johnson Park	3.00	5.00		
	3.50	6.00 TB		
WESTBROOK				
Delaware at North		Suites 6.00		
		Suites 8.50		
		Suites 9.00		
MEN'S HOTEL (Men only)				
308 Pearl			1.00	

*S, shower; T&S, tub and shower; TB, twin beds.

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1931-1932

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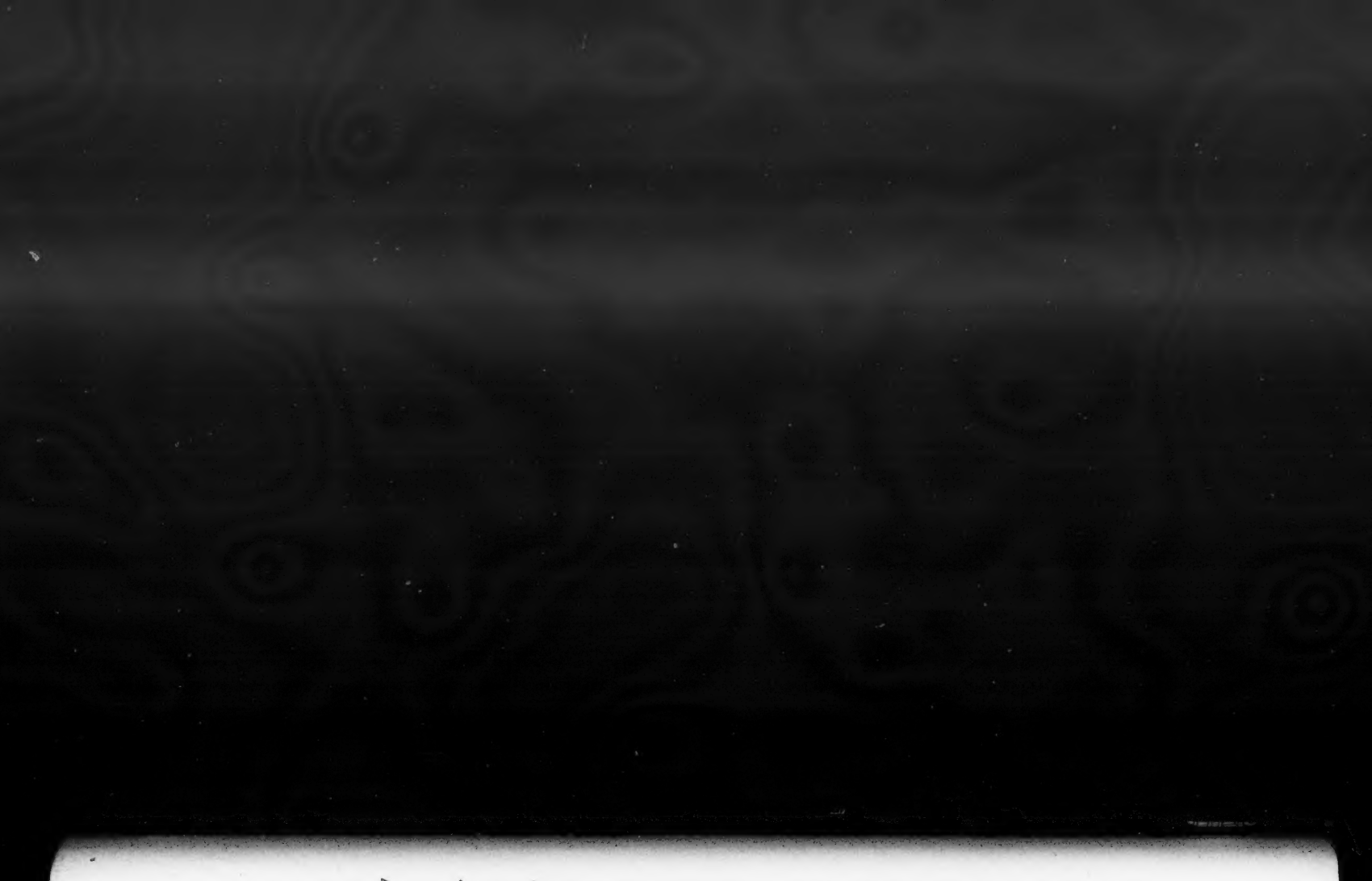
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